

SALT-WATER AQUARIUM FISH

(REVISED EDITION)



Chelmon rostratus. Photo by Earl Kennedy.

**Dr. Herbert R. Axelrod
and William Vorderwinkler**

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Note: In the listing of fishes in their families, the various species and subspecies appear in alphabetical order by their scientific (Latin) names.

Sam Richie

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This underwater photograph was taken by Rodney Jankloos in the coral reefs around Ceylon. The beauty of coral fishes has intrigued hobbyists for years, and it is only recently, with the advent of synthetic resin filters and artificial marine salts, that the hobby has grown to include millions of people all over the world.

Introduction

Perhaps more than any other facet of the pet hobby, the keeping of marine fishes has most benefited from the advent of the jet age. Today, fishes from the coral reefs of the Fiji Islands are less than 8 hours from the United States . . . and because of this much shorter shipping time, more fishes can be packed per bag, thus resulting in a much lower cost per fish. Add to this the new "sleep" drugs which reduce the fishes' metabolism to such a low rate that their oxygen needs are less than 30% of normal, and you have a situation which has resulted in the widespread adoption of marine fishes as standard pets in home aquaria.

As marine fishkeeping becomes more and more popular, so does it become more and more a business. While such pioneers as Joop Liet (who died in early 1962) of Amsterdam, Holland, Hans Schmidt of Frankfurt, Germany, Lee Chin Eng of Djakarta, Indonesia, Earl Kennedy of Manila, P.I. and Bill Jue of Oakland, California, are the real backbone of the marine fish hobby, there are now hundreds of dealers, collectors, exporters and importers who are mainly responsible for the 3,000,000 marine fishes which come to the United States each year.

In order to better understand the problems faced with the collection, transport and sale of coral fishes, the author (HRA) visited every major marine fish collector in the world during the period from 1959 to 1962. Throughout the book you will find photos of specimens from Ceylon where, in the Lumbini Aquariums, there were 80 different acclimated marine specimens; from Bimini where the resources of the Lerner Marine Laboratory of the American Museum of Natural History were put at the disposal of the author; from Hong Kong and Singapore; from Australia and Hawaii; from Pakistan and India; from Florida and Brazil, all of these places were visited, coral fishes were collected, photographed and identified.

Only after taking thousands of fish photographs and having lost most of the skin on your legs to coral burns, can you sit back and judge which fish should be included in your book. The author could not, in good conscience, limit this book to certain species from

certain areas. In the United States, fishes from our own Hawaii are naturally cheaper and more available, yet certainly Florida could produce many equally as beautiful and interesting. Yet more than 50% of our fishes come from the Philippine Islands and Ceylon. In this book you will find fishes from all the world. They are fishes which you, yourself, can have in an aquarium in your own home. They are expensive, costing between \$5 and \$10 each for the majority of them. Some are more costly. Marine fishes are fun, though, and you should really have at least one tank with one Batfish, *Platax*. Of all the fishes I have ever kept, I never enjoyed a species more than *Platax*. They eat from your fingers, love to be petted, and are generally very daring and hardy.

HERBERT R. AXELROD

Manaos, Brazil

November 15, 1962

I. Why A Salt-Water Aquarium?

For many years, it has been the dream of a multitude of aquarists to augment their collections with some of the gorgeously colored and bizarre fishes which inhabit the shallow waters of the tropical oceans.

Until recently, this feat has been considered fraught with difficulties and almost always doomed to only a short-lived success, at best, and an expensive one at that. After a great deal of preparation, the aquarist had to go to considerable trouble to travel (perhaps a long distance) to get the necessary amount of good, clean ocean water. This was then put into a specially prepared tank and carefully aerated and filtered.

Decorative plants being out of the question, the aquarium had to be adorned by something which itself came from the ocean and would therefore be harmless, namely coral. This, he found, was not exactly cheap. However, the real financial outlay comes when the aquarist decides he *has* to have a pair of those Clown Fish he has seen! Once he gets them installed in their new home, our friend feels that it really was worth all the trouble, as he now is the envy of all his aquarist friends . . . for a short time.

Then one day he comes home to find that the water in his prize tank has become cloudy, and that his costly pair of fish are gasping at the surface. Only thing to do, he decides, is to load the bottles and jars into the family car and scoot down to the beach for some fresh water. Upon his return, one of the precious Clown Fish is already a goner. After a lot of water-changing, our friend decides his marine aquarium is *not* worth the bother.

This story, with many gloomy variations, has been told for years. The only aquarists who had any amount of success were those who



A beautiful marine aquarium. Photo by Straughan.

lived near the seashore and were in a position to make frequent changes of water. Of course, the large public aquaria were able to maintain their salt-water tanks, but only with the help of expensive filtering equipment and considerable losses.

NEW METHOD FOUND TO CREATE SALT WATER

But, we now have good news for the prospective salt-water aquarist. Because of a recent development, which will be explained more fully

in Chapter 3, it is now possible for anyone to make his own salt water and keep it in use for years with new ion exchangers. The amazing thing is that marine fauna not only accept the substitute, but they also thrive on it, and the manufactured article has a stability not possessed by natural ocean water.

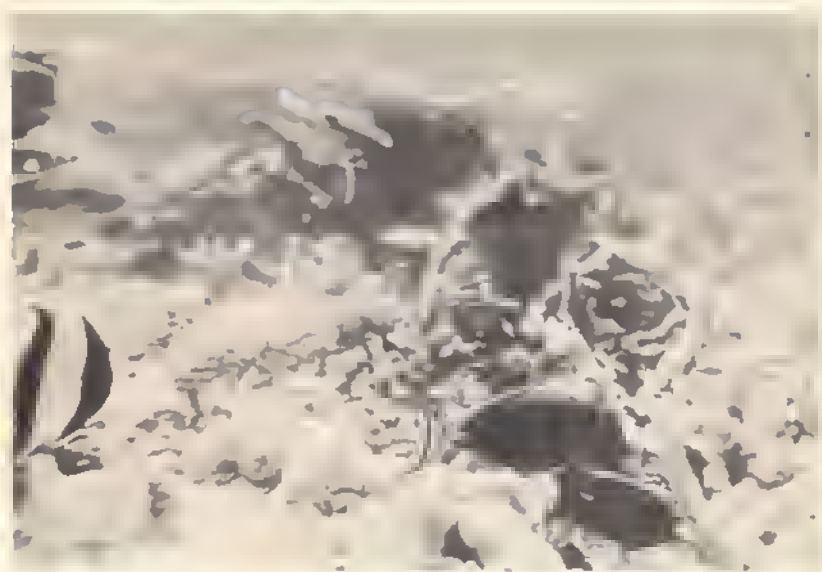
Thus it is now possible for an aquarist in a far inland state who has never even *seen* the ocean to transport a bit of marine life to his own home and study and admire its wonders at first hand. It is the purpose of this book to point out what can now be done, and how to go about it.

ELIMINATING PROBLEMS

So far, most "complete" aquarium books carry a small chapter, if indeed they have any at all, on marine aquaria, and in most of this space the author emphasizes the difficulty and complexity of maintaining marine aquaria. About ninety per cent of the difficulty lay in the maintenance of the water, which of course is no longer the problem it once was. Another bugaboo encountered was the main-

The use of plants in a marine aquarium is dangerous, even though some marine plants are available. The plants in this aquarium did well under the expert care of Earl Kennedy. Photo by Kennedy.





A coral reef is like a living picture with the ever-changing colors of the brilliantly-hued fish life darting everywhere. Photo by Rodney Janklaas.

tenance of a high degree of cleanliness. In the past few years, there have been many improvements in filtering equipment, too, making what was once an irksome task an easy one. Feeding was also a big problem. Fishes taken from the sea were deprived of their natural diet of plankton, and turned up their beautiful noses at what was offered instead.

At the old New York Aquarium, one of the sure-fire attractions among the marine exhibits was a large tank which contained a number of Sea Horses. There was always a crowd there. If it were not for the fact that the Sea Horses were one of their star attractions, the Aquarium would have been glad to discontinue the exhibit—it was one of their biggest headaches. The Sea Horses refused any food which did not move, and their small mouths and slow rate of locomotion made feeding them almost impossible. They were fed sparingly with fresh-water *Daphnia*, which could not live any longer than a few minutes in the salt water. The larger, stronger specimens would gobble up the *Daphnia*, which would die before the smaller Sea Horses could get to them. The result was malnutrition for a large percentage of the Sea Horses, and a high rate of mortality.

This occurred in the days before the discovery that the eggs of the brine shrimp (*Artemia salina*) could be dried and subsequently hatched at any time and in any quantity desired. The result is a food which remains alive in marine water until eaten. So it is now possible for the aquarist to culture his own plankton.

THE HIGH COST OF MARINE FISHES

With the food and water problems solved, there is only one snag left which, it is feared, will be with us for some time to come. Marine aquarium fishes still command a high price, when compared with fresh-water fishes. This is not the result of anyone overcharging for them. Practically all marine fishes have to be gotten the hard way; they rarely spawn in captivity, so they must be collected from the ocean. As most fish live among the coral reefs, it takes a lot of practice and patience to poke them out of their hiding places. They are swift, elusive and cagey and most of us would probably face financial chaos if we had to depend on fish-collecting for a living. Great

This is how a natural coral reef looks. When alarmed, the small school of fishes in the foreground disappears, as if by magic, into the coral.

Photo by Dr. Wolfgang Klausewitz.





Rodney Jonkloas attempts the difficult feat of herding a group of Clownfish, *Amphiprion polymnus*, into his net.



Once Jonklaas captures a fish, he keeps it in a plastic bag, adding new specimens as quickly as he catches them. It may take hours to collect even one specimen.

collectors such as Rodney Jonklaas and Earl Kennedy dive to a hundred feet just to chase a single specimen . . . and Jonklaas fishes in Ceylon and Kennedy in the Philippines!

This is only the beginning of a marine fish-collector's troubles. After being captured, many salt-water fishes do not take very kindly to a life in captivity, and the mortality rate is very high. Many of the newly caught fishes injure themselves trying to escape, and either die or have to be discarded. Then there is an additional ordeal: shipping. Although fish shipment is much speedier and more efficient than before air travel, some of our most beautiful and desirable fishes come to us from the Orient. With distances so great, shipping costs are high. Don't blame your dealer, then, if he charges what seems to be a high price for marine fishes; chances are his profit is smaller on them than for similarly priced fresh-water fishes.

COLLECTING YOUR OWN SPECIMENS

It is therefore advisable for you as a beginner to try your skill at first on specimens which you collect yourself, if you live in one of the coastal areas. There are usually some very interesting and attractive specimens to be found during the Summer months, whatever part of the coast you may try. (We will go into what species to look for in the chapter on "Fishes for the Marine Aquarium.") Remember, however, that the fishes you catch are not as likely to survive as those superior aquarium inhabitants which you may purchase. Fish have to become acclimated to life in captivity. On the other hand, it is a great source of satisfaction to go out on a nice summer day, armed with hand nets and a seine, and browse around in some bay or tidal pool to come home finally in triumph with a pair of Sea Horses or some colorful minnows.

The biggest temptation to avoid in this sport is overcrowding the containers you bring along for purposes of transportation. If you overcrowd, you will come home with a smelly mess. Pick your specimens carefully, making sure that they show no signs of injury, disease or parasites. You are wasting a day's efforts if you try to cram a number of fishes into a container big enough for only a few, hoping that at least some will survive the journey. True, some of them might, but they will be sick fishes when they get home, too. The strange, cramped environment in which they find themselves crowded will usually make short work of them. Start with just a few in a large container.

•

2. Setting Up Your Salt-Water Aquarium

PREPARING THE TANK

A little thought beforehand will save much grief afterward when setting up your marine aquarium. You must remember that, when set up, the salt-water aquarium will be a thing of great beauty and you will want to give it a prominent place in your collection. This does not necessarily mean the brightest, sunniest spot, as we must contend with algae in the marine aquarium as well as in the fresh-water tank.

An aquarium of less than 20 gallons capacity is not practical, unless you are going to be satisfied to keep just a few specimens of marine life other than fishes. Sea anemones, sponges, ctabs, shrimps and many other creatures are interesting to collect. Although your prime object is to keep the dazzling, brilliant coral fishes, of course, you will eventually want to keep the others, whether you begin with them or not, so why not set up an aquarium of proper size right away? Aquaria of smaller than 20 gallons capacity also foul very easily, and much more attention is necessary.

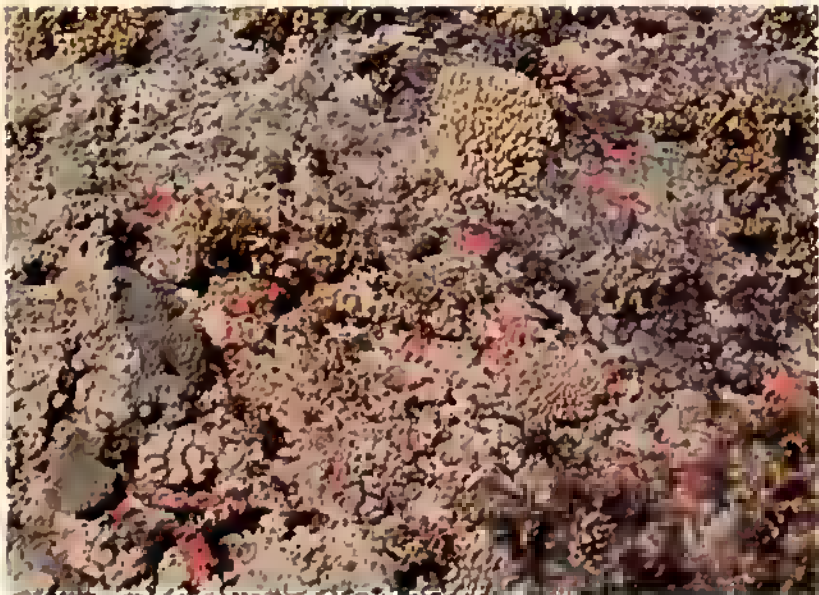
WHERE TO PLACE THE TANK

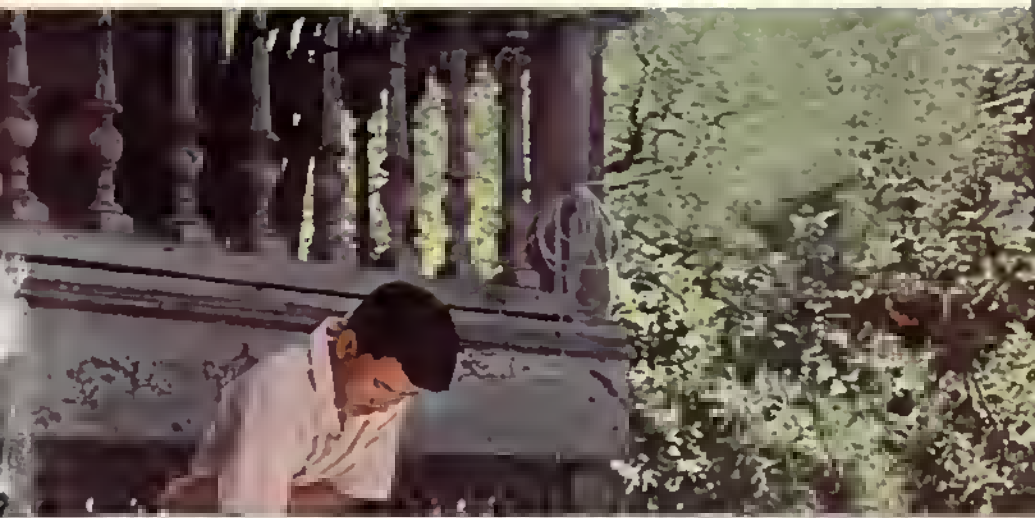
The marine aquarium has the same requirements as a fresh-water aquarium. It must have a solid base, preferably a heavy, steel aquarium stand. It should be located free from drafts and should not be too close to a radiator or heater where it might overheat. Then, too, direct sunlight for more than one hour a day can only mean green water and an unsightly aquarium. Perhaps the best place is a blind corner, away from windows, heat and cold. It is very easy for you to supply all the heat and light that your fishes need with a reflector on top of the tank and a thermostatically controlled heater.



The receding tide uncovers many interesting spots in the tropics, where collecting small fishes is a lot easier than diving for them. Photos by Dr. Herbert R. Axelrod, taken in the Fiji Islands.

A look at a coral bottom in shallow water.





Earl Kennedy's immense concrete aquarium in the Philippines.
Photo by Earl Kennedy.



Alfred A. Schultz, well-known morine oquorist who conducts his popular column "Solts from the Seven Seas" in the mogozine **Tropical Fish Hobbyist**, took this picture of one of his numerous morine aquaria.

After you have figured out where to put it, you must then fix your aquarium so that no water can touch any metal. There is only one metal which can be used safely as a frame, monel metal, and even this should remain insulated from the water. The reason is that when salt water brine comes in contact with most metals, salt is deposited, with disastrous results. An electrolytic action is set up, resulting in an oxide which will quickly upset the tricky balance of the water, with toxic effects. Some stainless steel framed aquaria are satisfactory—if the inside edges have been painted with asphaltum.

The ideal receptacle is an all-glass or all-plastic aquarium, but there the drawback is that these tanks do not come in large sizes. Our only alternative, then, is to take the metal-frame aquarium and make it impervious to salt water.

First of all, the inside edges where the glass comes in contact with the cement and all the edges around the inside bottom should be filled in with black asphaltum or epoxy waterproof paint. The inside top edge should then also be coated in this manner. Some of the manufacturers of high-grade tanks are now recognizing the growing popularity of marine aquaria and are putting out containers which are guaranteed impervious to salt water. The purchase of one of these can be the means of saving yourself some work, but an ordinary, less expensive stainless steel tank can be fixed up as just described.

PAINTING THE TANK

It would also be advisable to paint the back and two sides of the aquarium with colorful aquarium crystal paint. This paint, available at every pet shop, is easily applied and forms beautiful designs when it dries. Painting the sides and back will cut down on the amount of light entering the aquarium and will help to keep the glass clear of algae. Then too it will cut down on the shadows which enter the aquarium, for the marine fishes are usually afraid of moving shadows.

For those who want a more beautiful background than plain crystal designs, there are many full color decals which can be simply applied to the back and sides of the aquarium. They come in all sizes and are quite inexpensive.

Be sure no crystal paint gets on the inside glass or is sprayed on the water.

CHOOSING AND CLEANING THE SAND

After you have prepared your marine aquarium and selected a site for it, you should give some consideration to the proper sand to be used.

Conditions will be a bit different than those encountered in fresh-water tanks. In the fresh-water aquarium the rooted plants need a gravel which is dense enough to anchor the plants, and still coarse enough to permit a slight circulation of water among the roots, permitting nutrient matter to reach them. In the marine aquarium, however, we have no rooted plants to consider. True, a few salt-water plants will grow to some extent, but these draw their nourishment directly from the water, and have no true roots.

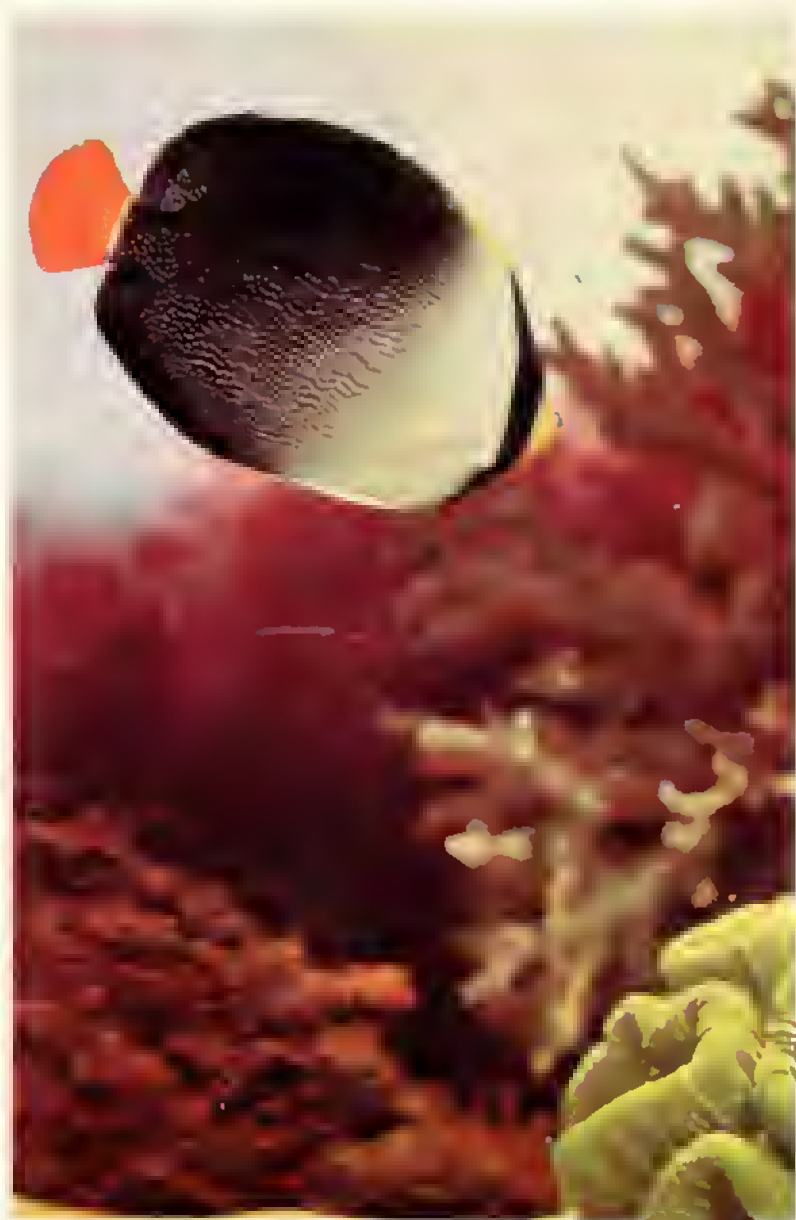
Cleanliness is so important in the salt-water tank that you cannot make use of a gravel so coarse that bits of uneaten food and detritus



The Sounders admire an aquarium set up for them by Lee Chin Eng in Indonesia. The aquarium is made of cement and tile and is very effective for marine use. Photo by Edgor Smith, I.C.A.

can seep into it, and remain there to decay and cause foulness. The use of a finely grained sand that packs rather tightly is therefore strongly indicated. All foreign matter will stay on top, where it is easily found for removal; or the waste will get swept into the filter intake, to be removed out of harm's way.

Beach sand may be used, if you can find some which is fine enough and colored to your liking. It must be freed of all foreign matter and impurities. There is always some contamination present in beach



This beautiful Red-tailed *Chaetodon* is in an aquarium. It almost looks as if the fish were in its native habitat. Many effective marine arrangements are possible in large marine aquaria. This photo was taken by the Malaya Straits Times in the Raffles Aquarium.



This marine aquarium was placed in front of another, giving a greater depth of view. Photo by Dr. Wolfgang Klousewitz.

sand, such as bits of dead crustacea, seaweed, etc., which must be removed. The best time to remove this is before you put the sand to use. Thorough washing is the answer. This not only does away with foreign matter, but also removes the dust-fine particles which would otherwise mar the perfect clarity of the water.

A good way to wash sand entails the use of an enamel wash basin and your garden hose. Place your basin where the overflow won't hurt anything, and regulate the stream of water from the hose so that you can stir up the sand vigorously without washing away anything but the foreign matter and the dust-fine particles. Don't overload the basin; one-third to one-half full is plenty. Poke the nozzle into the sand and move it around until nothing but clean water runs off. Remember, you don't want any fresh water in your marine aquarium, so avoid getting too much of it in with your sand. Drain the sand thoroughly before putting it in your tank.

Another thing to avoid is excessive sand depth. All you need in a marine aquarium is a half-inch or so, to cover the blackness of the slate bottom. A deep layer of sand is much more likely to become contaminated than a shallow one, and contamination must be avoided at all costs.

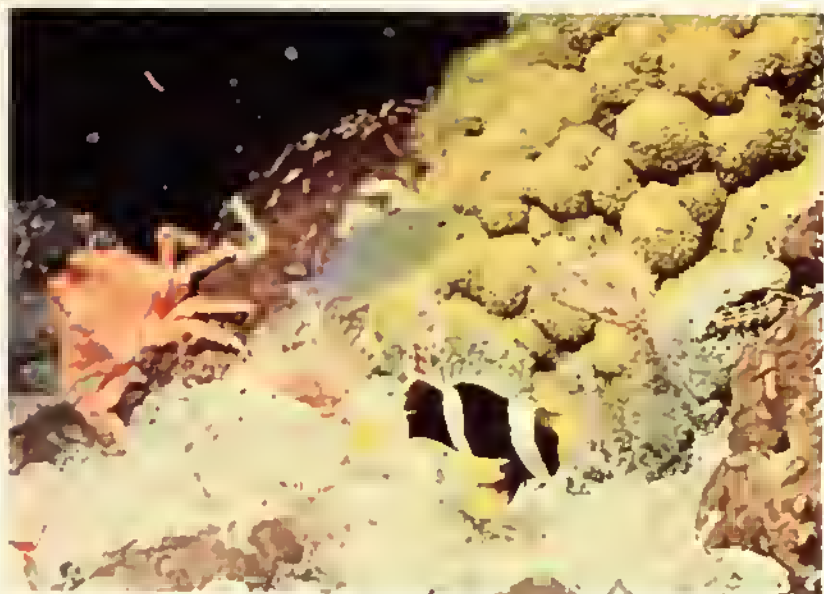
SELECTING ROCKS

Naturally, you don't want a bare tank with just water and sand. A beautiful jewel deserves a beautiful setting. Besides, your fishes will feel more at ease if they know they have something behind which they can duck if any danger, real or imagined, threatens. A marine aquarium is somewhat limited as to plant life, so the best bet is to place some decorative rocks where they will show to advantage.

Here again you must be doubly careful. After going to the trouble of insulating all the corners in the aquarium so no metal can come in contact with the water, it would be folly to put in rocks which have a soluble mineral content. You don't want porous rocks, either, for the same reason that you don't want coarse gravel; impurities can lodge in rocks of a basaltic nature, or other rocks which have no appreciable mineral content. Choose rocks like granite or marble, or glass rocks.

Here is another way to achieve depth. A piece of coral is placed behind the rear glass, making the tank look much deeper than it actually is. N.Y.Z.S. Photo.





A great variety of life can be kept in a healthy marine aquarium. Besides the two fishes (Blue Devil and Clownfish), there is a sponge crab on the left, two species of scallops at right center and a group of living corals at upper right. Photo by Robert P. L. Strougon.

BUYING CORAL

As you may know, coral is not a plant, but is formed from the skeletal remains of millions and millions of tiny polyps, relatives of the jelly fish. These little animals live in colonies. The formations we are familiar with are built by young polyps who grow up and smother their forebears in the process; they are in turn smothered by their own offspring. A small piece of coral probably takes hundreds of years to be formed. Imagine how many millions of years it must have taken to build up the huge Great Barrier Reef, 1260 miles long, 8000 feet deep and as much as 100 miles wide off the coast of Australia.

Coral, as we purchase it, is petrified and, of course, has all the living organisms removed. It comes in many shades. The most abundant and inexpensive species are white. Naturally, there are some rare and beautiful species which are quite expensive.

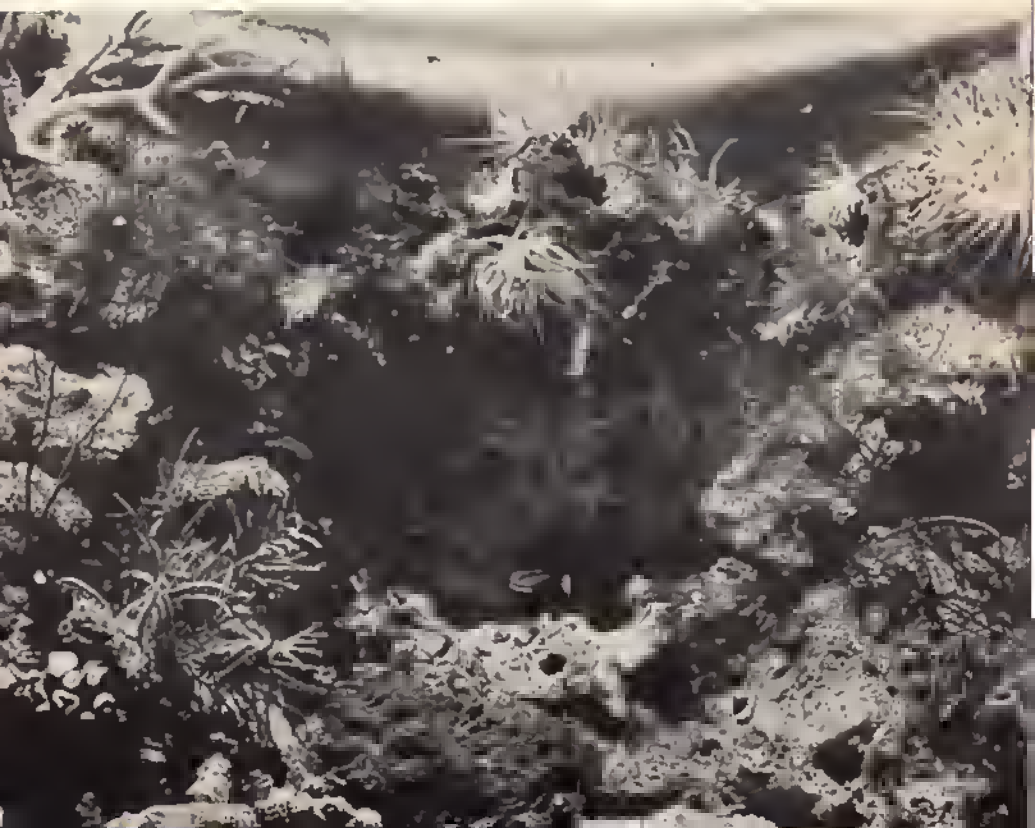
It sometimes happens that the cheaper white coral is dyed to make it look like the more expensive article. This "gilded lily" is no bargain.

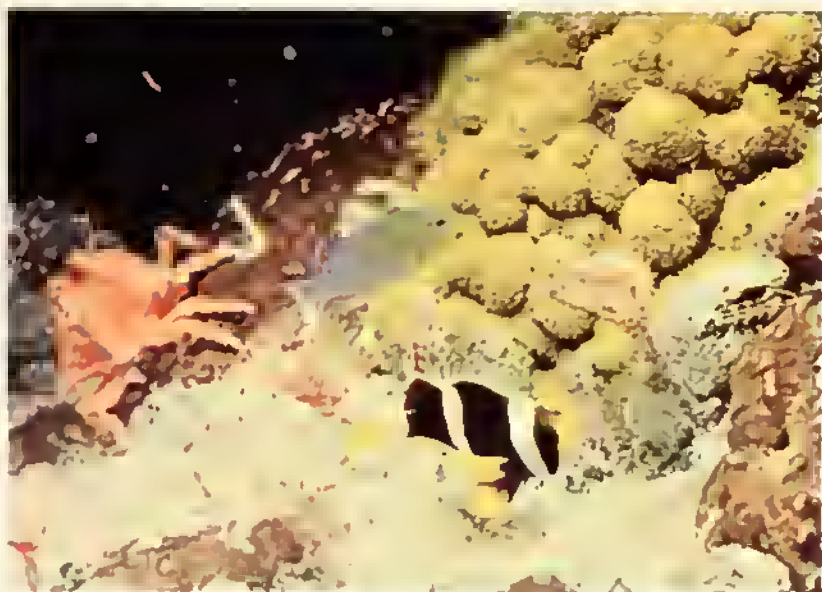
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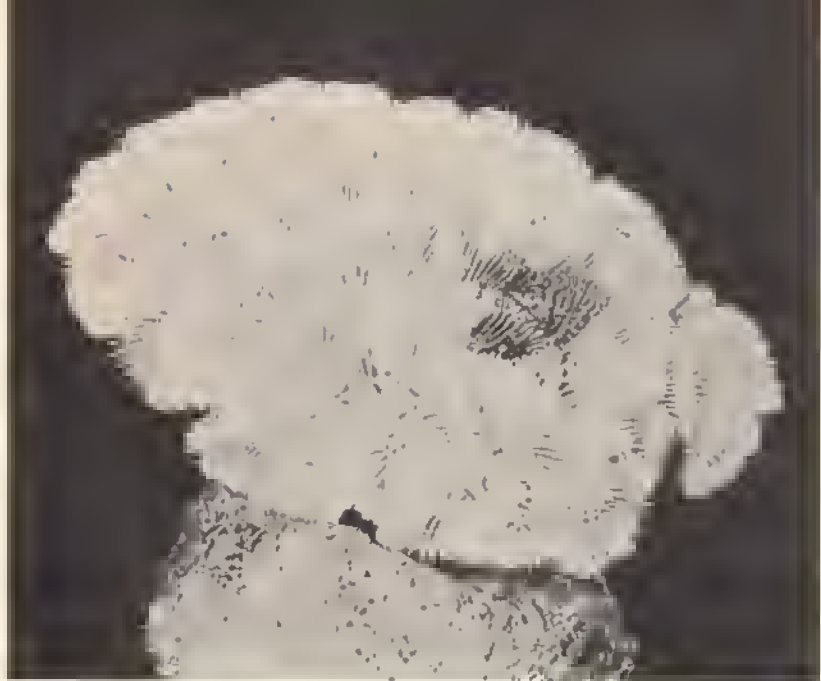
As soon as you put it in your marine aquarium, the hoax is exposed, and it is usually at the expense of some costly, hard-to-get fishes. Boil your coral thoroughly before using; if there is any chemical odor or stain in the water, boil it again and again until the water is clean. Only then is it safe for your aquarium.

SEA SHELLS

If you've ever seen salt-water fishes in nature around a coral reef you know how important a good hiding place is to their general well-being. Though fish psychologists are rare (they go under the name of "animal behaviorists"), they all agree that a sense of security is as important for a fish's health as it is for a human being's.

The bizarre Shrimp Fish are easily kept, and their strange head-down method of swimming makes them an excellent "contrast fish." Photo by Edgar Smith, I.C.A.





Rose coral is a very popular aquarium decoration, N.Y.Z.S. Photo.

The Sea Fan is not a plant, although it resembles one. It is the skeleton of an animal, making it an excellent decoration. N.Y.Z.S. Photo.





If you are devoting a tank to Seahorses, branch coral has the added advantage, besides being very attractive, of giving an anchorage to the Seahorses, who can wrap their tails around the branches. N.Y.Z.S. Photo.

A Mediterranean Surgeanfish (*Acanthurus* species), "grazing" on the coral and algae in its native surroundings. Photo by Dr. Wolfgang Klauswitz.





The photo above was taken by Edgord Smith in Indonesia. It shows one of Lee Chin Eng's 'natural method' aquarium. There is no filtration and only a bit of aeration to keep the water moving. Note the variety of colors and the extreme intensity of coloration in the fishes. On the facing page is a photo by Franz Lozi which shows the 'old method' of keeping marine fishes. This photo was taken in Germany and the tank is heavily filtered. Everything is meticulously clean and the fish have a 'sterile' coloration. Both types of marine aquarium are successful, but if you have success with Lee Chin Eng's method, your fishes are much more colorful and your marine aquarium is more interesting and educational.





Such a profusion of fishes can only be presented in large tanks, like those of the New York Aquarium, where this picture was taken. N.Y.Z.S. Photo.

Don't use ordinary sea shells as hideaways for coral fishes, because they may contaminate the water. There are many imitation sea shells on the market that serve the same purpose. These shells are usually made of porcelain or china. They are highly colored and have been fired in a kiln so they will be inert as far as salt water is concerned. Some fishes will even be induced to spawn in these shells, and little fishes love to play around them.

Consult your fish dealer for his ideas on what hiding places should be maintained for your livestock. If he fails to help you, visit your florist and look for some of his fancy porcelain or china flowerholders. Many flowerholders have intricate caverns which will enable your fish to hide away in their own type of solitude.

BEWARE OF PLANTS

It is a great temptation for the aquarist when setting up a salt-water aquarium to add a beautiful, lush lot of marine plants. This is fine at first, but a sure headache later on, when the plants begin to deteriorate, as they almost always do.

There are a few tips, however, which may lead to some success. In the first place, never use a brown plant; red or green ones are less likely to lead to trouble. If you can find a plant anchored to a rock, chip off the rock with the plant attached to it. It is more likely to thrive.

Use plants sparingly, and watch them closely until growth is noticed. Marine plants require a good deal of sunlight, but become hosts to brown or blue-green algae when the light is too strong, just as fresh-water plants do. When this begins to happen, the algal growths can be controlled in the same manner, that is, cutting down on the light, enough to discourage the algae, but not enough to discourage the plant. Where this point exists can only be established by trial and error, as it varies under different conditions.

As a general rule, stay away from plants in the marine aquarium. There are many artificial plants which do look rather real in the water, but even these should be avoided until you have the experience to recognize distress signals in the aquarium. Be satisfied to utilize corals, rocks and imitation shells for your decoration. The fish are beautiful enough without a very gaudy background.

THE "NATURAL" METHOD OF LEE CHIN ENG

In Djakarta, Indonesia, one of the world's most enthusiastic marine aquarists, Lee Chin Eng, discovered and promoted a "natural" system for keeping marine fishes. His idea is so unbelievable that the author made a special trip to Indonesia to see it for himself.

Lee Chin Eng took pieces of living coral, complete with all the assorted life to be found along with it, and put it into the giant marine aquariums that he maintained in Djakarta. He took away all his filters and just had a small airstone with a few bubbles to give some slight movement to the water to better simulate nature. In a few days the coral "came to life" with small anemones blossoming out, featherworms, small crabs and other crustacea darting forth, and small polyps making their amazing appearance. For months the



Lee Chin Eng of Djakarta, Indonesia, the discoverer of the 'natural method' for keeping marine fishes with living corals and living plants and invertebrates. The success of his method led to the first successful spawnings of marine fishes, though none have ever been raised to maturity in captivity. Photo by Edgar Smith, I.C.A.

coral grew and more and more life was evident. As the coral grew, so did the fishes. The water remained crystal clear and the most fantastic things began to happen! The marine fishes started to spawn in this natural environment. Unfortunately, of all the various species that spawned, none ever raised the fry to adult size, but this was the first giant step in the right direction.

Advanced aquarists all over the country tried desperately to achieve the same results, but few had success. Merrill Cohen, one of the leading dealers of marine fishes in Baltimore, Maryland, set up numerous tanks with the living coral he imported from Lee Chin Eng. It took him years before he started to get the successful experiences that Lee Chin Eng had repeated over and over again. Aquarists in Germany, England and Canada also tried the Lee Chin Eng system. Most had poor luck, but the ones that did succeed were the only people who ever successfully spawned marine fishes. The author tried the scheme. It looked beautiful, kept the water fairly clear, but none of the fishes ever spawned. Perhaps you will have better luck?

A marine aquarium with Mediterranean fishes. Photo by Dr. Wolfgang Klausewitz.



3. Water—The Main Ingredient

The most important item which contributes to a fish's well-being is, of course, the medium in which he lives. As long as the water is kept pure, clean and at a proper temperature, your tank inhabitants will remain quite healthy, provided they are not crowded or subjected to injury by their fellows. It is therefore of utmost importance that you provide them with the best water available, and keep it that way.

OCEAN WATER

For those of us who live along the coast, it may seem a simple matter to go to the shore and dip out the needed amount of ocean water, but there is more to it than that. In the first place, ocean water is not sterile, and often contains some pollution. Even the cleanest ocean water contains myriads of micro-organisms, as well as larger animals. When taken from its natural surroundings and placed in the comparatively close confines of an aquarium, a change takes place in ocean water, causing many of the micro-organisms to die off rather rapidly. If the water is not well aerated and filtered while this transition is taking place, it can become foul and useless. However, the constant circulation set up by aeration keeps these micro-organisms moving, and the filter picks them up and removes them from the water. At the end of about two weeks, the water should be crystal clear and only then is it safe to introduce your fishes, gravel, etc.

A word of warning when collecting sea water: *Never* use a metal bucket unless it has an enameled surface. Otherwise, you are doing what you have taken pains to avoid with your tank—letting the water come in contact with metal. Have you ever noticed how different drinking water from a tin cup tastes? For transportation and storage

of sea water try to get some large glass earboys, such as are used for transporting acid. Another good container is the plastic bag which fits into a corrugated cardboard container, in which most fish shipments are made today. These bags and boxes can be obtained from most dealers, and have the advantage of taking up very little space.

THE SPECIFIC GRAVITY OF YOUR WATER

One of the greatest problems in the salt-water aquarium is the maintenance of a fairly constant density (specific gravity) of water. Sea water is heavier than distilled water, the greater weight being attributed in the main to the dissolved salts contained in the salt water. When we use a figure like 1.020 as that of the ideal density (or specific gravity), it means simply that the water in question is 1.020 times as heavy as an equal volume of distilled water. Special hydrometers are sold in pet shops with which you can easily measure the density of your sea water.

A specific gravity of 1.020 is the optimum density for the successful maintenance of small marine fishes. A normal deviation of 0.003 is acceptable, but care should be exercised that the density gets no higher than 1.025, nor lower than 1.016. Should you be interested in maintaining larger specimens of fish, then the lower ranges of density are more desirable, whereas the *microscopic* marine organisms require at least a density of 1.025. If you are collecting your own fishes, ascertain the salinity of the water from which your specimens are taken, and maintain this salinity.

It is important to remember that a certain amount of evaporation takes place all the time in your aquarium. The water is the only part that leaves—the salts remain. Therefore, the water must be replaced with an equal amount of fresh water to maintain a steady specific gravity. If you live in an area where the tap water is not very hard, it may be used to replace evaporated water.

The best water to use for replacement, of course, is pure distilled water. This is entirely free of organic impurities, and adds to the aquarium exactly the same type of water which was lost by evaporation. (Here again the bugaboo rears its ugly head: Make sure that the water was distilled in glass, rather than in copper.)

SYNTHETIC SEA WATER

For many years, aquarists and laboratory technicians made numerous attempts to produce synthetic sea water by combining the

various salts and chemicals found in sea water, but their efforts met with varying success. Mostly these mixtures were tricky, working well at times, and not so well at others.

However, there are several commercial preparations now on the market which give uniformly good results. It is merely necessary to take these salts, mix them with soft tap water, and (presto!) you have water which in many cases is superior to the natural article!

In synthetic sea water there are no micro-organisms present to die off, and therefore the water does not have to go through the seasoning period required for natural sea water. As soon as all the salts have combined thoroughly with the fresh water, it is ready for use. We are also assured that there is no pollution present.

When the salts are mixed according to directions, the salinity of the water will be found to be somewhere around 1.025. This can be adjusted according to requirements, more water to reduce the specific gravity and more salts to raise it.

These are some of the Atlantic species which can be collected in Florida. Left to right: Porkfish, Angelfish, Spiny Boxfish and Spiny Lobster. N.Y.Z.S. Photo.



The former major problem in creating synthetic sea water hinged around the loss of the minute trace elements, present in sea water, but missing from old synthetic mixtures. The newer formulae take the trace element problem into consideration. These salts are not a hit-or-miss proposition; when used properly, they provide a medium which is far superior to the average ocean water. These salts are buffered to the correct pH.

Anyone, anywhere, who has the other necessities, can now maintain a marine aquarium.

Our growing knowledge and experience in this field will no doubt lead to the successful propagation in tanks of these little charmers, as has been done with practically all the fresh-water aquarium fishes. Some of our skilled aquarists and breeders who have succeeded with the more "difficult" fresh-water fishes will now turn their talents toward the propagation of marine tank fishes. A "tank-bred" strain will prove to be much hardier (and easier in turn to breed) than the original wild strain. A wild fish in captivity adjusts itself to its surroundings to a certain extent. But there can be no more perfect aquarium fish than one which is hatched and raised in these surroundings, and knows no others.

THE ACIDITY OF YOUR WATER

Until now it has not been possible to determine the acidity (pH) of a marine aquarium. The test kit for fresh-water aquaria is not accurate when used in salt water. However, there has just appeared on the market an inexpensive marine pH kit, which is still not too accurate, but is a guide. (Better kits may soon be available.)

You will need a pH kit if your fishes start dying for apparently no reason. This may occur about 70 to 90 days after you set up the artificial salt water, and it will probably be due to the pH of your tank. If this happens to you, get yourself a pH kit and see if the pH is where it should be—at 8.3 or close to it. If the pH has dropped to 7.0 or 6.8, this is much too acid, and you will need to add sodium or calcium carbonate to the water. Add enough to bring the pH back to the 8.3 level. The sodium carbonate will remedy the situation in a few hours.

As a general practice, it is wise to add about one ounce of sodium or calcium carbonate to your aquarium filter (so it spreads gradually through the entire aquarium) every month. This amount is suitable



Don't make the mistake of thinking that all pH test kits can be used for either fresh or salt water. This kit will do an excellent job with fresh water, but not with salt water. Make sure your kit states that it is for use with salt water. Photo courtesy of Wil-Nes Corp.

for a 20-gallon tank, so if your tank is smaller or larger, use that figure as a base. Calcium carbonate is a little better than sodium carbonate.

LIGHTING YOUR MARINE TANK

In a bright location, light is no problem during the daylight hours. But we also want to enjoy our aquarium at night, probably more so than in the daytime, so what do we do?

There is one special condition with a marine aquarium which does not exist with fresh-water: the metal parts inside the shield of the reflector must be protected from the water. True, the evaporated water which comes in contact with the metal parts of the reflector is fresh, but remember, it drips back into the aquarium. The simplest way to prevent this happening is to place a cover glass on the aquarium which, instead of just reaching to the reflector, covers the top completely. This will prevent most of the evaporated water from escaping, and will also keep it out of the reflector.

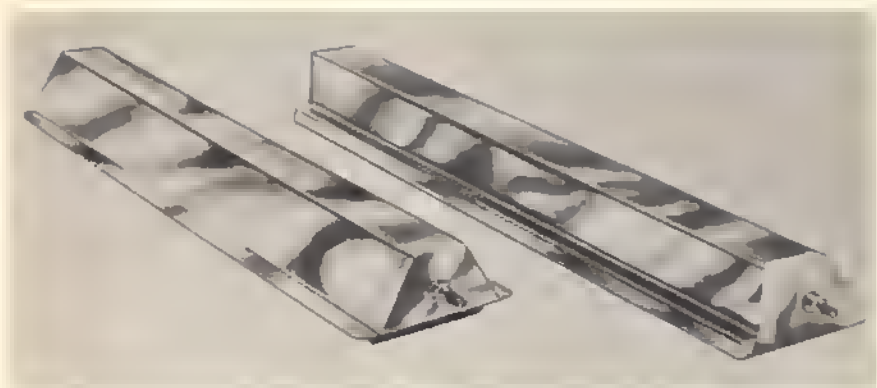
If a fluorescent tube is used, the reflector may be placed right on the cover glass. On the other hand, if incandescent bulbs are used, a great amount of heat is developed, and the cover glass may crack unless an air space is left between the glass and reflector, to permit some of the heat to escape. With the aid of a little mechanical ingenuity, it is possible to anchor your reflector in front of the tank, tilted toward it. The correct distance and angle may be determined by holding the reflector in different positions until the best lighting is arrived at. Most times a small wedge will suffice to hold it in position.

Incandescent light gives us a good, natural light which can be controlled as to brightness by changing wattages of bulbs. There is the disadvantage of heat, and the danger of cracking the cover glass unless precautions are taken. Fluorescent lighting is more economical; it gives much more light per watt of power consumed, and has the added advantage of much less heat. The initial outlay is a little higher, but is less expensive in the long run.

The usual choice for fluorescent lighting is a tube whose wave length is at the red end of the spectrum, such as the type known as "Warm White." This is close to the color of incandescent lighting, and gives us a natural-looking illumination which enhances the reds and yellows. On the other hand, a bluish light, such as the so-called "Daylight" tube, tends to cut these colors down. The bluish might

This full hood should be placed atop a glass cover to prevent rusting.
Photo courtesy of Wil-Nes Corp.





Here are two types of reflectors which cover only part of the tank. Water must not condense and drop back from inside these reflectors, or metallic poisoning will eventually occur in a marine aquarium. Photo courtesy of Wil-Nes Corp.

be more natural in the ocean depths, but not as desirable in the marine aquarium, where we are trying to emphasize colors rather than wash them out.

If you duplicated exactly a scene from the ocean depths in your aquarium, it would not be a very colorful picture. For, as you descend, the light begins to fade. The predominating colors down deep are different shades of blue. The reason for this is that the water above filters out all colors on the red end of the spectrum. Strangely enough, some of our reddest corals and other creatures come from the deeper regions, where red is not recognizable as such until a light is brought down. Perhaps a bright red color is a protection in these regions, and it is Nature's intention that these "roses" are born to blush unseen.

FILTERING DEVICES

The marine aquarium must be kept scrupulously clean and free of contamination. It is, of course, possible to do this by fussing around daily with a dip tube and picking up droppings; by feeding sparingly and at the same time making sure that no uneaten food is left. This is entirely too much trouble for the average aquarist, and even if he has the time to do these housecleaning chores, he would rather spend it observing his fishes. Besides, poking around with a dip tube or siphon is a sure way to frighten the fish.



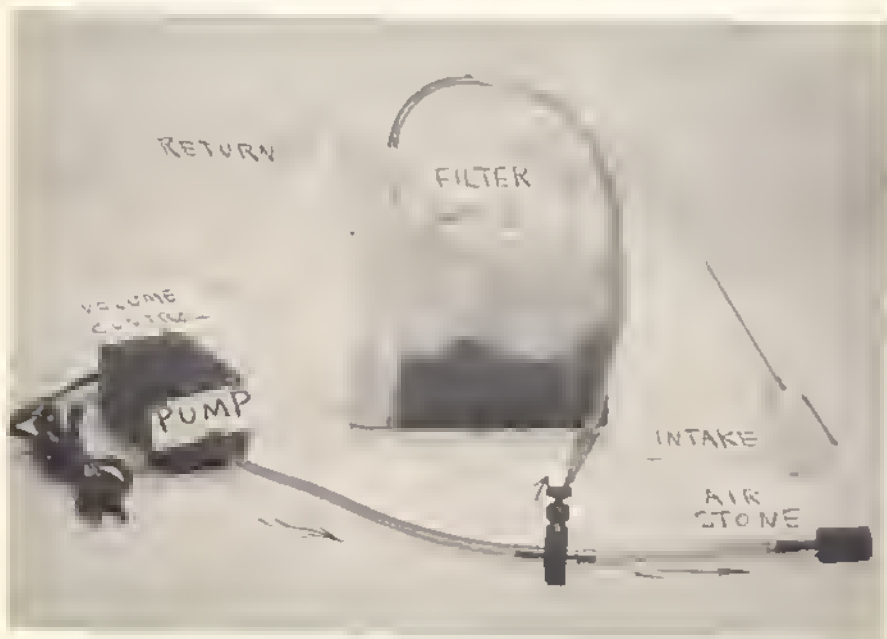
A standard filtering set-up showing a vibrato-type pump operating on outside filter. This arrangement is an excellent one for a small home marine aquarium. Photo courtesy of Patt Engineering Co.

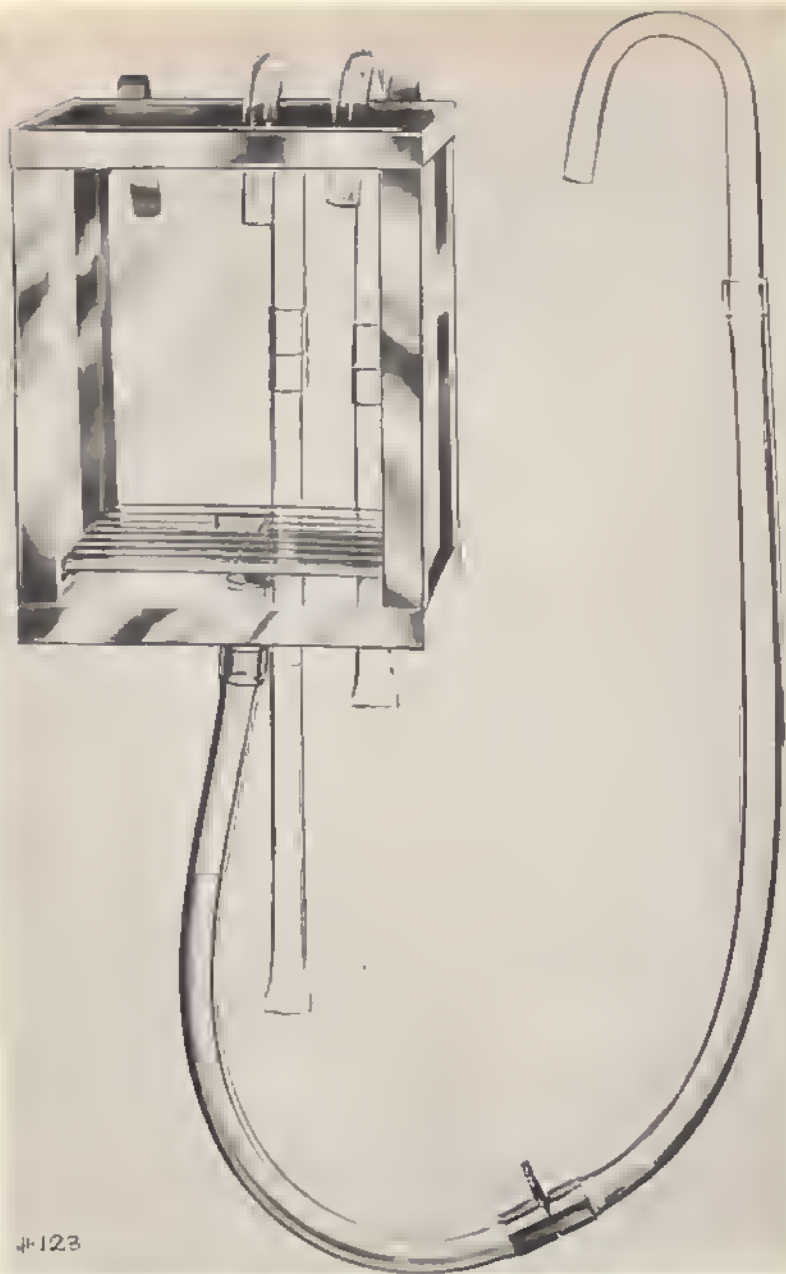
It used to be true that only the more prosperous aquarists were the owners of air-pumps and filtering equipment. Now it is an unusual aquarist who does not own some kind of pump; some have even installed compressors! If you have only the marine tank to be filtered, a vibrator-type pump is ample for the purpose.

A good-sized filter is also important, not only because it will handle a larger volume of undesirable wastes, but because it can be run at a higher speed, thereby creating a perceptible current in the aquarium. Marine fishes are accustomed to water with a rather high oxygen content, and the greater the action at the water surface, the more oxygen you are supplying. Use a filter which would be a bit oversized for a similar job in the fresh-water aquarium. For example, a filter which would be used in a 20-gallon aquarium with fresh water would be about right for a 10-gallon marine aquarium.

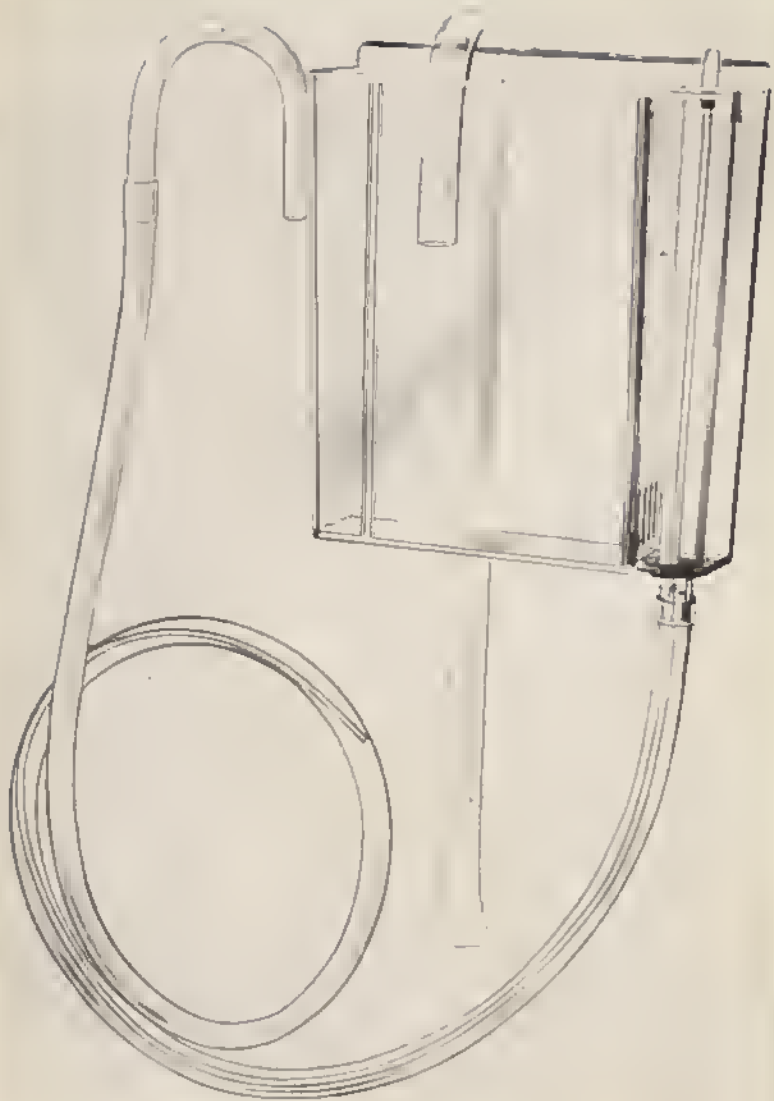
An outside-type filter is preferable to an inside one; it handles a greater amount of water, and can be cleaned conveniently. A very efficient filter is the so-called "high-lift" type. This consists of a unit

This is the proper method of hooking up a pump, filter and airstone.
Photo by Mervin F. Roberts.





A better method of filtering as well as circulating the water is this "high-lift" filter. The long air-lift tube for returning clean water can be placed so that it will enter on one side of the tank while the dirty water is being picked up on the other. All metal parts exposed to the water must be coated with a rust preventive. Photo courtesy Metal Frome Aquarium Co.

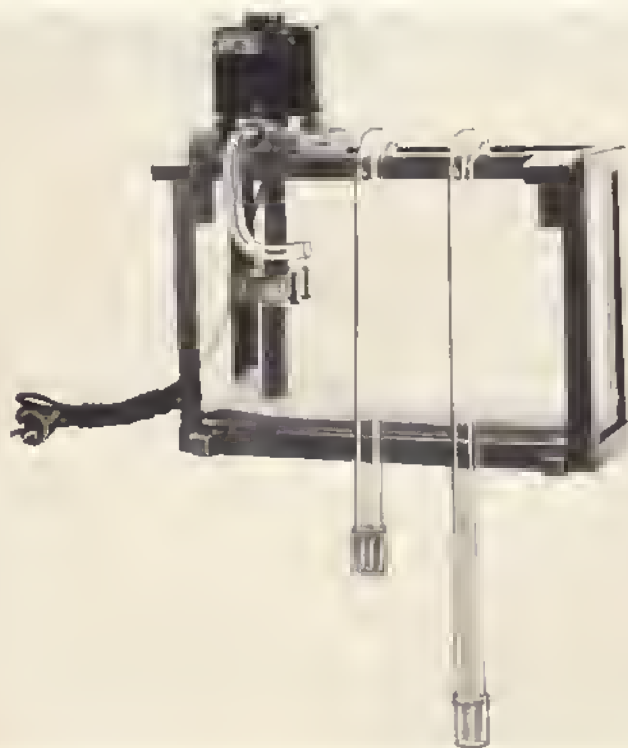


No need to worry about coating any part of this filter, which is all plastic. Note how the amount of lift can be adjusted by lengthening or shortening the air intake tube inside the air-lift tube. Photo courtesy of Wil-Nes Corp.

resembling an ordinary outside type, except that it has an outlet at the bottom. The water, after passing through the filtering medium, drains into this outlet to a plastic tube which hangs below the level of the aquarium. It then comes up to return to the aquarium on the other end. At the low point of this return, there is an air intake into the filtering system which gives a tremendous lift, because of the stream of bubbles traveling through this long tube before being released. This type of filter is capable of handling many times the capacity of an ordinary filter, and has been found to be exceptionally good for a large marine aquarium.

There is another very efficient type of filter, which has been developed recently. This consists of a plastic box with two compartments. The filtering medium is placed on one side; a small pump

This is a so-called "power filter," which pumps back the filtered water, while two siphon tubes pick up the dirty water at separate levels. The power filter is by far the most powerful of all aquarium filters and is perfect for marine aquaria. Photo courtesy of Eugene Danner Mfg., Inc.





If only a small volume of air is required, the most economical means of providing it is by the use of a vibrator pump like this one. Photo courtesy of Metal Frame Aquarium Co.

mounted on the other side pulls in the dirty water and pours it on the filter medium, after which the water is returned. The whole arrangement hangs inside or on top of the aquarium, and can handle as much as 100 gallons per hour. It creates a very desirable current.

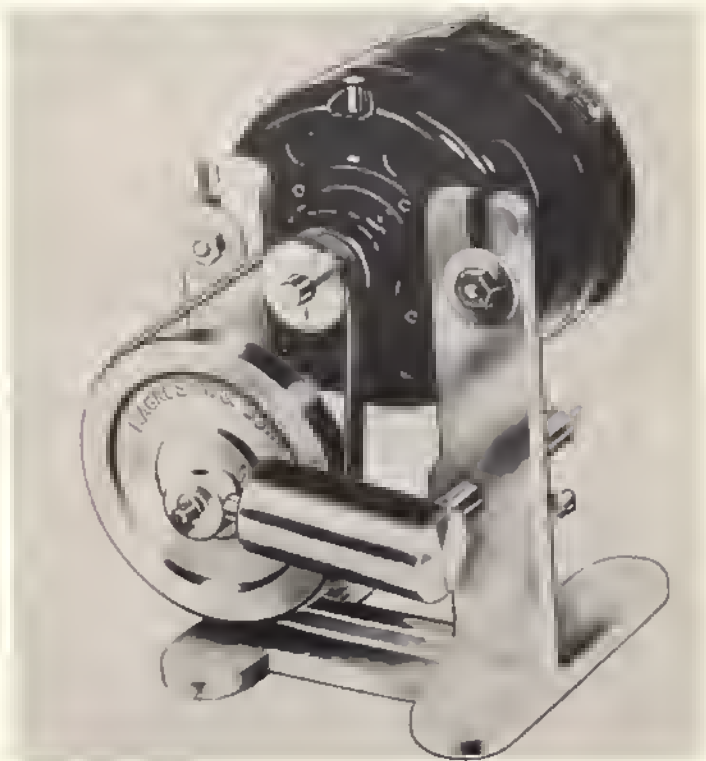
It may be wise to inject a note of caution at this point. For siphoning the dirty water into the filter, do not use the kind of water intake tube which has a wide-open end going into the aquarium. Some of your fishes may become inquisitive and try to poke themselves into this tube, thereby smothering themselves. Coral fishes love to hide in small cracks and crevices and you might lose very valuable fish by having them get stuck in an intake stem. Use an intake tube which draws the water through small holes or slots. These are more efficient in any case because if one slot or a few holes are blocked, the water can still pass through the others.

It may be found that in a large aquarium with a filter at one end, there is a tendency for the dirt to accumulate at the other. A smaller filter at each end is a simple answer to this problem. Try, wherever possible, to purchase the type of filter which removes the water from one end of the aquarium and returns it at the other, so dirt will not stay in one spot.

The usual filtering medium in a marine aquarium is a layer of charcoal, topped with a layer of glass-wool. Some aquarists use sand instead of charcoal. This is not as good, for even though the charcoal loses its gas-absorbing properties fairly rapidly, it does, nevertheless, serve admirably as a mechanical filter medium and it breaks up the flow of water just enough to insure maximum aeration and filtration without loss of circulation.

It goes without saying that only plastic (no metal) filters should be used.

Sooner or later you'll require more air than the vibrator pump can deliver, and the answer in most cases is a piston pump.

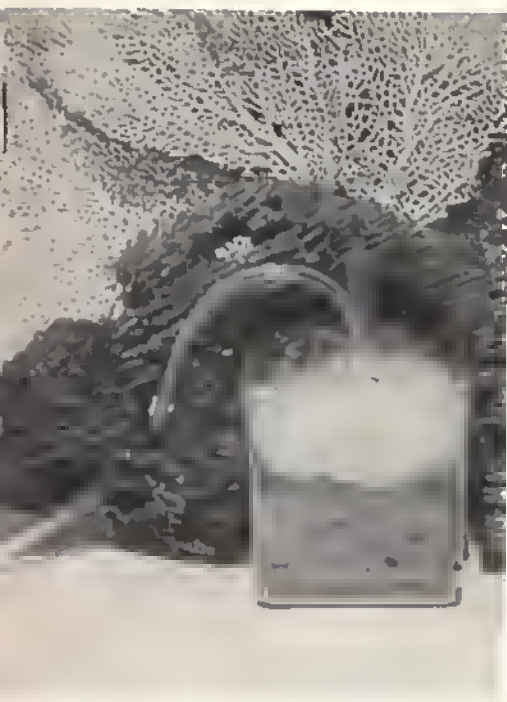


SYNTHETIC RESINS KEEP AQUARIUMS SPARKLING

There were two things which made marine aquarium keeping so popular and successful: the proper formulation of artificial marine mixes and the invention of synthetic ion exchangers. It is impossible to say exactly who was the person primarily responsible for the application of the combination of synthetic resins and special bone charcoal to marine aquariums. In America, Mr. Richard "Dick" Boyd of Los Angeles first brought it to the authors' attention. His product was marketed for a few years and then disappeared from the market. About the same time, in Germany, another product appeared under the name "Ionic Marin" which made the same claims that the Boyd product did. The German product seemed to work a bit better, but was quite a bit more expensive. Essentially the synthetic resin/charcoal mixture was able to keep artificial seawater in perfect condition for two or three years without changing it. It further aided the fishes in some miraculous way by removing very toxic "fright" substances from the water thus making the fishes feel more relaxed. The author first used it in 1958 and his experience stands out so vividly in his mind that it is worth repeating. A 50-gallon aquarium was set up for several months and it contained a few *Platax*, some Clownfishes and a few odds and ends. The *Platax* so ruled the aquarium that the other fishes spent most of their time under the coral branches, hidden from view and subsisting on whatever food came their way. When the author put the "Ionic Marin" material in the filter a dramatic thing happened. Within two hours all of the fishes which were hiding swam into full view, caring not the least about the *Platax*. They came right to the author's fingers to take food and were tame from that day on. Newly imported marine fishes which refused to eat, started taking food within hours after their water was filtered through this filter medium. It truly made marine fishkeeping easier than fresh-water aquarium management.

AERATION

Most aquaria with efficient filters do not require additional aeration. A good filter not only cleans the water, but also keeps it circulating, thereby insuring a good supply of oxygen. However, it is possible to help the filter along with an air release in the right place, opposite the air intake. An air release will lift the unwanted wastes and push them toward the filter intake, where they are then picked up and dropped



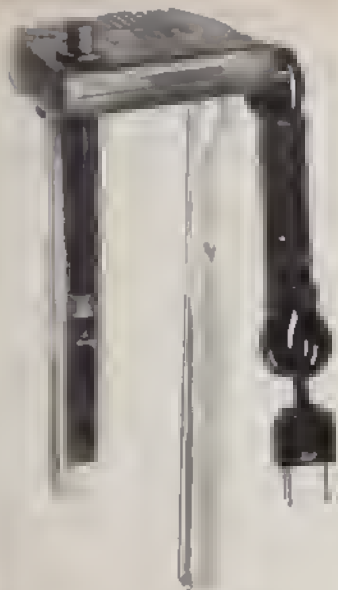
In a small, uncrowded tank it is possible to make use of a small inside filter, as is shown here. These can be concealed by cutting away a recess in a lump of soft, porous coral. Photo by Douglas Foulkner.



A behind-the-scenes view, showing the pipe-organ coral which has been hollowed out, with the filter concealed in it. All that can be seen from the front are the bubbles! Photo by Douglas Foulkner.

into the filter. Some air releasers incorporate some metal; they would not last long in salt water, and neither would your fish if they were used. Use an air stone which is of non-metallic construction; there are plenty of the carborundum type available.

Where there is no filtration being used, aeration is practically a "must." It keeps bringing up the water from the bottom regions and circulating it toward the top. If heat is being used, this insures an even temperature all around. It was once believed that the tank water absorbed some oxygen from the stream of bubbles, but it has since been proven that it is the moving water at the surface, brought there by the action of the bubbles, which is responsible for an increased oxygen and decreased carbon dioxide content.



This heater and thermostat combination has no exposed metal parts, and is completely safe to use with salt water. Both photos courtesy of Wil-Nes Corp.



The "completely rustproof" feature applies because this thermometer is all plastic. It is much safer to avoid using a thermometer which introduces metal into the water. Use an all-glass thermometer in the marine aquarium.

CONTROLLING THE TEMPERATURE

In the case of tropical marine fishes, there are wide differences in the temperatures of their native haunts. The deep ocean's temperature, for instance, is much lower than that of a comparatively shallow tropic pool. You will find that marine tropicals generally are quite comfortable at 65° to 75° F., and that higher temperatures are apt to cause them some discomfort due to a reduced oxygen supply.

When planning a location for your marine aquarium, choose a place away from heat sources. In a normally heated room, the tank heater should be regarded as a device which, rather than raising the temperature, is merely to prevent the water from chilling when the room heat drops. Some people turn off their heat during the night. A large aquarium in this sort of situation takes quite a while to drop a few degrees in water temperature, and this slow cooling is not nearly as harmful as a rapid drop. The heater serves as a sort of "cushion" when these drops take place.

Say the temperature of your tank is 73°. This is a suitable temperature, and the heater should not be functioning at this time. During the night the temperature of the room is controlled by thermostat to drop to 65°. This is a fine way to economize on the fuel bill, but your aquarium fishes could easily suffer from such a drop. The thermostat of the aquarium should therefore be set at about 70°, to prevent a harmful chilling.

This also holds good for summer temperatures, where the water might normally be in the neighborhood of 80°. This temperature, high as it is, should not be permitted to drop too rapidly, and the aquarium thermostat should be set only a little way below this point, say at 75°.

Cold-water marine aquarium fish are very apt to "take a beating" in the summer months. Keep them in the coolest place available,

A small all-plastic aquarium will hold only a few small fish, but is leak-proof, non-toxic and ideal for a small marine aquarium. Photo by Robert P. L. Straughan.

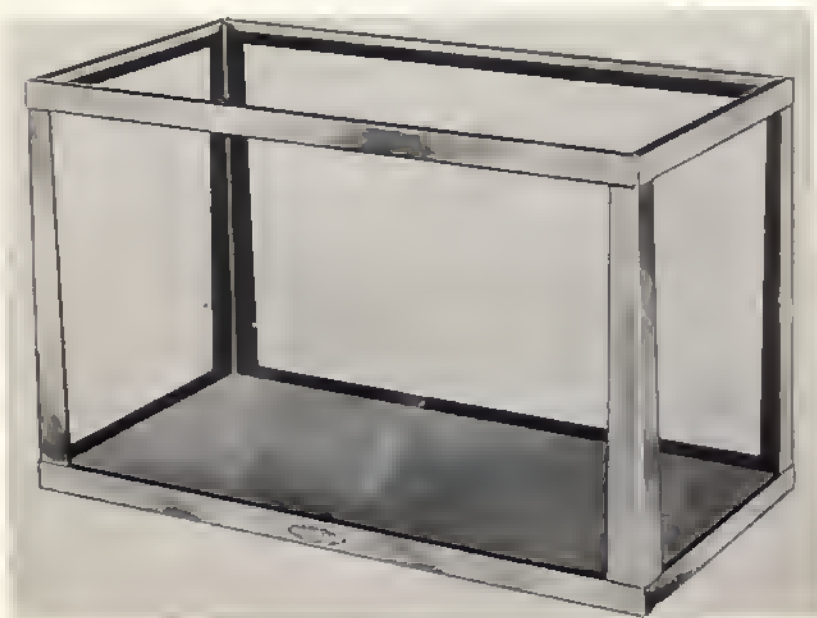


where no direct sunlight can reach them. Aeration is desirable. If a cover glass is used, it should be removed in the daytime, to be replaced in the evening, as a precautionary measure against sudden drops in temperature.

THE FISH CAPACITY OF YOUR TANK

Here we have one of the greatest drawbacks for the aquarist when he decides to try marine fishes. Salt-water aquarium fishes cannot be crowded. Even with aeration, we must figure on only half of the old "rule of thumb" which was used for goldfish. This was: an inch of fish per gallon of water. In salt water we must figure an inch of fish to *two* gallons of water. In other words, a 20-gallon aquarium should not contain more than five two-inch fishes. There are, however, a few species like Sea Horses and Pipe-Fishes which are not very active and are extremely peaceful. In this case, the formula may be doubled. The number of fishes a given aquarium will safely maintain is in direct proportion to the aeration, circulation, filtration and cleanliness of the aquarium, while it is inversely proportional to the temperature.

Still the most popular aquarium is the standard one with a metal frame, slate bottom and glass sides. Inside metal surfaces should be coated with liquid aquarium cement.



A constant problem when keeping plastic aquario clean is how to remove the algae without scratching the surface. The trick is to do it frequently and use sponge pods like these. Both photos courtesy of Wil-Nes Corp.



Two sizes of plastic aquario. It is always best to lean toward the larger sizes.



Catalog # 15



Catalog # 25

4. Feeding Salt-Water Fishes

It was once quite a problem to feed marine fishes properly in captivity, especially those which insisted on living foods. However, it is now possible for any aquarist to supply himself, at a very reasonable cost, with excellent food which can be hatched and used as desired. This, of course, is the brine shrimp, *Artemia salina*.

There are at present two commercial sources from which we get our brine shrimp eggs: Little Manitou Lake, Saskatchewan, Canada; and the Pacific coast at San Francisco. There is not a great deal of difference between the shrimp from these two places. Both are excellent nutritionally, but the Canadian variety is considerably larger when hatched than the California variety and is, at the present time, much cheaper. The quality is equally good. Sorting methods now insure practically all fertile eggs being separated from the lighter, infertile ones and the percentage of hatched eggs is consequently very high.

Explicit instructions on how to hatch the eggs are given when purchased, but if you do not have them, here they are:

Canadian eggs: Dissolve 4 tablespoonfuls of non-iodized salt and 2 level teaspoonfuls of 20-Muleteam Borax to each gallon of water. Use a round glass container, such as a fruit or pickle jar. Never use a square one. In a pint jar, use $\frac{1}{4}$ teaspoonful of eggs; in a quart jar, $\frac{1}{2}$ teaspoonful; and in a gallon jar a level teaspoonful. Aerate freely, enough to keep the eggs circulating. Eggs hatch in about 56 hours, and may then be siphoned into a fine-meshed linen or nylon net, from which they may then be removed and fed. Use Wardley's Hatching Mix for best results.

San Francisco eggs: Dissolve 4 tablespoonfuls of non-iodized salt to a gallon of water (no Borax). Place in a shallow container and add $\frac{1}{4}$ teaspoonful of eggs for each gallon. With aeration, the amount of eggs may be increased somewhat. Hatching time is about 36 hours; siphon and strain through a fine-meshed cloth, as with the others.

One thing must be emphasized here: Do not put the unhatched eggs directly into the aquarium, reasoning that it is salt water and they will hatch there. The fish will not wait, and may suffer considerable digestive upset from eating the unhatched eggs.

Frozen adult brine shrimp is a superior fish food also.

Do not feed brine shrimp exclusively—even if it is an excellent food, your fish will eventually tire of it. Vary with other foods. Some foods ordinarily fed to fresh-water fishes are also quite acceptable to your marine specimens. Tubifex worms may be fed, as well as *Daphnia*. However, it must be remembered that both of these foods are not native to salt water and die quickly, therefore just enough for immediate consumption may be fed. *Enchytrae*, or White Worms, last a little longer, and are also an excellent food. Mosquito larvae, when you can find some, are a wonderful food.

One should also vary this diet with marine foods. Chopped clams, mussels, crabs, shrimp and oysters should make up some of the diet. Bits of fish roe or chopped-up bits of fish are also acceptable.

While we are on the subject of foods, here is a bit of advice which should be engraved on your memory, *never* to be forgotten: Feed sparingly, and you will have your fish for a long time. Overfeed and, you may lose them all overnight!

Gluttons that they are, fishes are not harmed by overeating. They are seriously harmed, however, when their water becomes foul due to the presence of decaying uneaten food, the source of billions upon billions of harmful bacteria.

The fresh-water aquarist is sometimes faced with the same catastrophe, but he can rectify things quite easily by siphoning out the decaying matter from the bottom, and replacing part of the water. Marine water must usually be replaced in its entirety when it goes bad, and with a large tank this is quite a tall order. A little care when feeding can save a big headache later on.

Ordinary crab meal and shrimp meal make excellent dry food for marine fish, and if this diet is supplemented with some frozen brine shrimp, your fish will not suffer from dietary deficiency.

5. Diseases of Salt-Water Fishes

Until now, lack of sufficient specimens in aquaria has prevented experimentation in learning about and curing diseases of salt-water fishes. The few places that have maintained marine fishes, such as the large public aquaria, have kept their disease control methods secret. And, in the salt water areas which are the natural habitat of the fishes, the specimens that become ill are usually gobbled up by other predatory fishes before we can learn anything. However, although salt-water fishes are just as susceptible to disease as fresh-water fishes, epidemics, for reasons other than water pollution, are unknown among marine fishes. This is not to say that epidemics of diseases do not occur, but merely that we do not know of them.

What we know about diseases of fresh-water fishes has come from the cultivation and observation of these specimens over a period of many, many years. But marine fishes have been maintained in home aquaria for only a few years. In the preparation of this chapter, the authors had an unlimited number of *Fundulus* (killies) to work with, and quantities of various drugs for experimental work.*

DRUGS AND STERILIZATION

Most aquarists have used Aureomycin, Terramycin, Penicillin, or one of the other wonder drugs. You measure the drug into a small glass and dissolve it in enough water to facilitate its even distribution through the aquarium. These familiar drugs, peculiarly enough, are of little value when used individually in the treatment of marine fish diseases, but are effective when used in combination with each other.

*These were supplied through the generosity of Charles Pfizer & Co., Brooklyn, N.Y.

It is far wiser to prevent disease in any case than to cure it with drugs. Therefore, you must first take precautions. It is of the utmost importance that marine fishes be sterilized as soon as they are received. All importers of salt-water fishes use for sterilization a solution of potassium permanganate and *fresh* water—25mg. to the gallon of water. You can do the same. Place the fishes in the solution for a few minutes. If they show signs of discomfort, remove them, but usually they can take 2 or 3 minutes in the solution without too much difficulty. Then place the sterilized fish in your aquarium. The potassium permanganate is very inexpensive and can be purchased at your pet shop.

If disease strikes your aquarium at any time, remove the fish and sterilize them in exactly the same way. Then place them in a fresh (new) salt-water tank.

Some importers of marine fish will tell you that they prefer copper sulfate, but this is much more dangerous to use than the potassium permanganate, and the latter will serve your purpose.

One of the Surgeon Fishes, *Acanthurus hepatus*. N.Y.Z.S. Photo.



GENERAL TREATMENT FOR DISEASE

The potassium permanganate treatment should be used not only for sterilization but for every disease that affects your marine fishes. This treatment has been found successful with bacterial infections, and should be the first treatment you try for all diseases. Since it is practically impossible for you or even your dealer to know the exact type of organism that is attacking your marine fishes, you must give this same general treatment to all your sick fishes.

But, before looking for disease, make sure that something else is not wrong. Check the pH of your water, and make sure it is close to pH 8.3. Check with your hydrometer and see that the specific gravity of your water is close to 1.025 and steady. Make sure that your aeration and filtration are in order and your aquarium is clean and has been maintained at the proper temperature. Now, if these are all right, and your fish has not been chewed up by a predacious monster, and did not jump out of the tank and spend a few minutes bouncing around on the living room carpet, you can look for fish diseases and not for man-made maladies!

POISON

The higher activity of salt water on metals makes it imperative that there be no metal-water contact in the marine aquarium. If there is a contact, there will be every reason for you to suspect that your fishes might die of poisons produced by this action.

Fishes that are poisoned this way usually suffer a tortured, suffocating death. They die slowly, one by one, until the concentration of lethal substances in the water makes it impossible for any life to survive.

As soon as you observe this condition, move your fish into another aquarium. Some fish are bound to die after the move as the metallic salts will have done their damage, but others will survive if you make the move in time. Again, the old story, an ounce of prevention. . .

FINROT, TAILROT AND BODYROT

Open sores, torn fins, ragged fins, all symptoms of finrot, are usually caused by marine bacteria. It may surprise some readers that there are bacteria in sea water, but the oceans are literally "loaded" with them. However, there are many antibiotics that work

wonders in reducing bacterial populations in salt water. The following drugs have been found to control marine bacteria successfully:

250 mg. of Penicillin per gallon; treatment repeated every 12 hours.

250 mg. of Chloromycetin per gallon; treatment repeated every 24 hours.

250 mg. of Thiolutin per gallon; treatment repeated every 24 hours.

250 mg. of Rimocycin per gallon; treatment repeated every 12 hours.

250 mg. of Polymyxin per gallon; treatment repeated every 12 hours.

250 mg. of Bacitracin per gallon; treatment repeated every 12 hours.

A mixture of 250 mg. of Chloromycetin and 250 mg. of Neomycin for every two gallons of water; keep fish in until cured; no repeated treatment necessary.

A mixture of 250 mg. of Penicillin and 250 mg. of Streptomycin for every two gallons of aquarium water; keep fish in this solution until cured; no repeated treatment necessary.

The best treatment of all is the combination of Chloromycetin, Penicillin and Streptomycin. Use 250 mg. of each for every 3 gallons of aquarium water. This treatment is effective for every bacterial infection of marine fishes. A single dose is effective for 10 days or more depending upon conditions in the aquarium.

RULES TO FOLLOW

If your marine fishes become ill and you don't know what is wrong with them follow this procedure:

1. Check the pH of your water, and, if necessary, add sodium or calcium carbonate to bring the pH to 8.3.
2. Sterilize the fishes in the potassium permanganate solution.
3. Remove the fishes to another aquarium with freshly prepared marine water.
4. Add 250 mg. of each of the following antibiotics for every 3 gallons of aquarium water: Penicillin, Streptomycin and Chloromycetin.
5. Maintain a close check on the specific gravity of the water and the temperature. Use full aeration and filtration.
6. Keep sick fish isolated until completely cured.

6. Fishes for the Marine Aquarium

The warm seas all over the world abound with interesting, bizarre, beautiful and almost unbelievable forms of fish life. Some of these fishes have been classified and well known for centuries; many are still unknown. It is a highly painstaking task to go over an area and list the fish life alone. An ichthyologist might spend a year in one area, making the closest possible study, only to find that he missed much in a nearby area. Some places literally teem with certain species for a time, and suddenly the fish disappear for no apparent reason. These cycles are sometimes almost predictable. By going back over previous records, the reappearance of certain fishes can be forecast, at times correctly, but never infallibly.

The fishes with which this book is concerned are those which can be kept successfully in a home aquarium. There are many fishes which might be kept in the close confines of a large public aquarium, but which would soon perish in the still closer confines of a home aquarium. These are not only the larger specimens, but also those which school in off-shore waters, the pelagic fishes. These do not take well to life in captivity. They are very active, and by being active consume much oxygen and require an almost constant food supply, as well as much more room than we could possibly give them in the home aquarium.

There are also great numbers of deep-water fishes which we must rule out because they could not live in comfort, if indeed they could live at all, at the surface temperatures and pressures of the small tank. Their conditions are impossible to reproduce in the aquarium, even if it might be possible to bring up occasional specimens alive to the surface.

STUNTING GROWTH

This leaves the shore and reef fishes. These must be limited to the species which are small in size. This limitation is not as confining as might generally be believed because of the stunting effect of life in a tank. Some of the smaller species, which, for example, would attain a length of 3 inches in native waters at maturity, will still attain this length in captivity. But, some species of fish, which would attain a length of 8 inches in the wild state, might only grow to be 4 inches long in an aquarium, if raised from a still smaller size. Aside from the stunting of its growth, the fish does quite well, so we can include the young of some of our medium-sized fishes as candidates for our marine aquaria. This presents us with a wide field.

COLLECTING SALT-WATER SPECIMENS

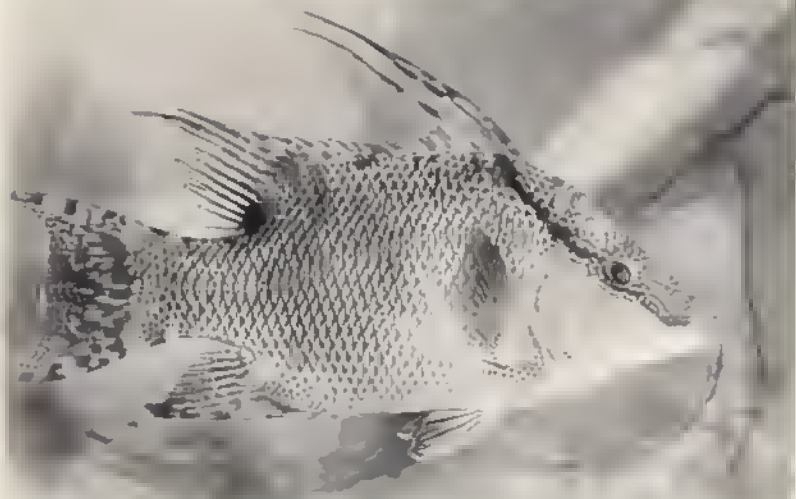
The warm seas of the world provide us with the most beautiful specimens of marine fishes. The shallow coral reefs harbor a life which is so brightly colored that a fish with all the shimmering colors of a butterfly fits right in with the background, never standing out against it.

Many of our popular and less expensive marine fishes are captured around Florida. Several enterprising collectors have supplied thousands of fishes to dealers all over the country.

If you think that a collector of marine fishes has an easy living, you would change your mind quickly on first trying to outsmart a shy, cagey little demon of a fish ducking in and out of a coral reef to get him into a net. Sick or damaged fish are no good. Those which are caught must be kept for a while, to acclimate them to a life in captivity. The result is that some fish damage themselves, making them useless. Bad weather forces a collector to stay in port. The danger of injury always exists, not so much by sharks, morays or barracuda, but by scraping against rough coral growths. All in all, it is hard work.

Doubtless there will be some easier ways devised in the future to make fish-collecting an easier task. Collectors may soon trap fish in a manner similar to that used for trapping eels in our more northern waters. There is also a wide new field of scientific endeavor which is still open to much exploration, namely that of breeding marine fishes.

Only a very few marine fishes have done their owners the honor of breeding for them. It is possible, however, to capture ripe fishes



The Hogfish, *Lachnolaimus maximus*, is attractive but seldom available in sizes small enough for the home aquarium. N.Y.Z.S. Photo.

and strip the females of eggs and the males of milt, mixing the two together and thereby obtaining fertile eggs. This has been done in laboratories, and has resulted in hatchings. From this point on, however, the experiment has failed; it seems that no suitable food could be found to keep the fry alive and start them growing. This problem does not seem so insurmountable for a skilled breeder.

To get back to fish-collecting, there is another great source of marine fishes around the Malayan Peninsula, and the islands of Borneo, Java, Ceylon and Sumatra. There are also a good many species which may be gathered around the Hawaiian Islands. A rich source of supply would probably be the Great Barrier Reef of northern Australia, but unfortunately this region is not available.

The catalog of fishes which follows is as comprehensive as it is possible to make at the present time. Where there is a known popular or local name, it is given. The Hawaiians are prone to give the same popular native name to several species, but the descriptions as well as the scientific names will serve to distinguish them from each other. As with our own American fishes, there may be several popular names; this often happens when a fish has a wide range. Some fishes have a

very wide range, and it may be possible that they appear in a few places which are not mentioned. All known local names are included, whenever the information is available. Remember also that the species mentioned here are not available at all times. You will find that even well-stocked dealers have only a few species, and you may have to wait patiently for a long time until the fish which has caught your fancy becomes available. It's all part of the game!

STOCKING THE HOME AQUARIUM

There is not as much compatibility among marine fishes as with the fresh-water species. It is best to get them used to each other when they are still small, rather than put larger fishes together haphazardly.

The beautiful green eyes and tremendous orange pectoral fins make the Sea Robin an attractive specimen. A very common species along the Atlantic coast of the United States in the warm months. Photo by Gunter Senfft.



Some species are able to inflict wounds upon others to which they have taken a dislike, and new introductions should be watched closely at first. Sometimes it may be wise to separate a new species being introduced to the tank from the other fish by means of a glass partition. The older inhabitants will get used to him without being able to get at him. When the novelty has worn off, the partition may then be removed; the new fish will often be accepted without any undue fuss.

Before you actually buy the fishes for your marine aquarium, you must decide on what kinds of fishes you wish to maintain. Whenever possible buy fishes of approximately the same size. This greatly reduces the chances of having your fishes fight with each other for homes and food.

Also some salt-water fishes are jumpers. Make certain that your aquarium is covered, not only to reduce water evaporation and to keep out dust, but to keep the fish from jumping onto the living room floor some evening.

Since recognizing the sex of a marine fish is very, very difficult, you cannot be too concerned about obtaining mates for breeding, though we all hope that soon it will be possible to have tank-bred marine specimens!

The Squirrel Fishes

Family Holocentridae

These stocky little fishes are easily recognized by their red color and large eyes. There are quite a few species native to the Pacific, and two species from the Florida coast.

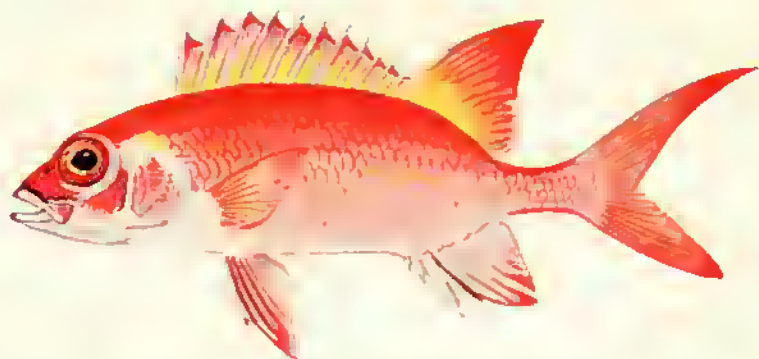
Young specimens are sometimes available to aquarists; they are inclined to be a bit shy in the aquarium, and should be provided with ample nooks and crannies where they make take refuge if danger threatens.

Some of the local names for this attractive fish are: Soldier Fish, Squirrel Fish, Welshman, Soldados, Matajuelos, Malau, Alaihi, etc.

SCIENTIFIC NAME: *Holocentrus ascensionis* Osbeck.

POPULAR NAME: Squirrel Fish.

RANGE: This is the common Florida species, the one most likely to be among the fishes offered by East Coast collectors.

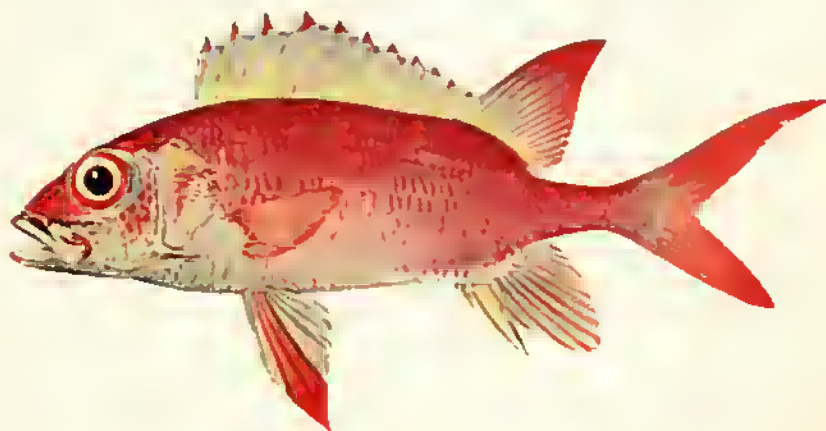


Holocentrus ascensionis from Florida.



Holocentrus scythrops is a Squirrel Fish which is abundant around the Hawaiian Islands. Photo by Dr. Herbert R. Axelrod.

Holocentrus furcatus from the South Sea Islands.



DESCRIPTION: Mostly red, with rows of indistinct stripes on the sides. The tail is deeply forked.

SIZE: Wild specimens seldom exceed one foot in length.

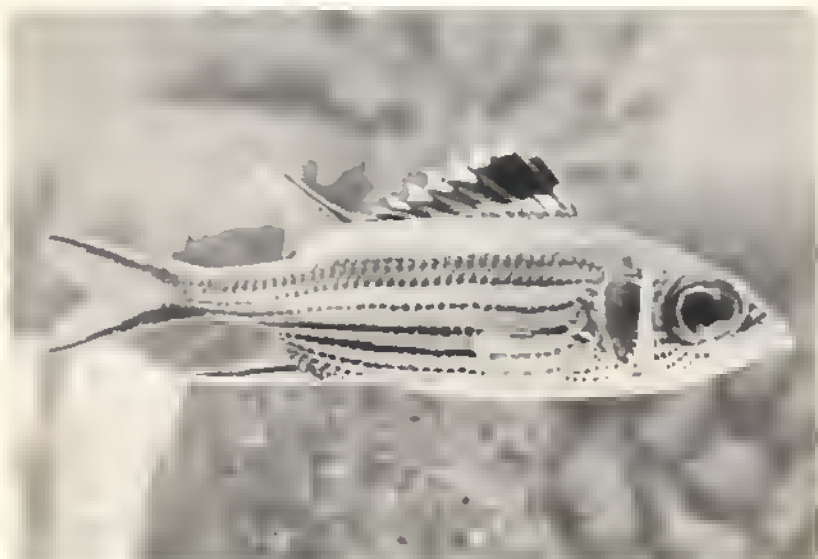
SCIENTIFIC NAME: *Holocentrus binotatus* Quoy & Gaimard.

POPULAR NAME: Squirrel Fish.

RANGE: New Guinea, Guam and Samoa, possibly the Hawaiian Islands.

DESCRIPTION: Upper half of the body is striped with alternating red and blue, lower half with alternating red and white. Dorsal fin carries a brown blotch.

SIZE: Attains a length of 5 inches.



Holocentrus diadema. Photo by Wilhelm Hoppe.

SCIENTIFIC NAME: *Holocentrus diadema* Lacepede.

POPULAR NAME: Alaihi Kahaloa.

RANGE: From the Red Sea to Tahiti and the Hawaiian Islands.

DESCRIPTION: Deep red sides, marked with eleven horizontal white lines; the spiny section of the dorsal fin is black, mottled with red blotches.

SIZE: Small; wild specimens get to be only 7 inches long.

SCIENTIFIC NAME: *Holocentrus erythraeus* Gunther.

POPULAR NAME: Red Squirrel Fish.

RANGE: East Indies Islands eastward through the South Pacific, northward through the Hawaiian Islands.

DESCRIPTION: Deep red above, golden below, with violet iridescence. The first dorsal, which is also red, has a white area between the spines. The other fins are also deep red.

SIZE: This beautiful fish attains in nature a length of about a foot, but young specimens will stay much smaller.

SCIENTIFIC NAME: *Holocentrus furcatus* Gunther.

POPULAR NAME: Squirrel Fish.

RANGE: Throughout the South Sea Islands, as far north as the Hawaiian Islands.

DESCRIPTION: Bright red, marked with golden horizontal stripes. White beneath.

SIZE: Wild specimens attain a length of 10 inches.

SCIENTIFIC NAME: *Holocentrus lacteoguttatus* Cuvier.

POPULAR NAME: Squirrel Fish.

RANGE: Has a wide range, from the Red Sea through the Indian Ocean, the East Indies and the South Pacific islands as far north as the Hawaiian Islands.

DESCRIPTION: Rosy red above, plain white below. The sides are marked with alternating deeper and lighter red stripes.

SIZE: Large specimens may attain a length of 11 inches in nature, but young specimens will stay much smaller in aquaria.

SCIENTIFIC NAME: *Holocentrus microstomus* Gunther.

POPULAR NAME: Small Mouthed Squirrel Fish.

RANGE: Guam, Wake, and the Hawaiian Islands southward. Common in Samoa.

DESCRIPTION: This species is distinguished by having a smaller mouth than the other members of the family. It is reddish in color, with 9 or 10 horizontal lighter stripes.

SIZE: Another small species; maximum length of wild specimens is 8 inches.

SCIENTIFIC NAME: *Holocentrus sammara* Forskal.

POPULAR NAME: Squirrel Fish.

RANGE: Throughout the Indo-Pacific area, a fairly common species.

DESCRIPTION: Reddish brown above, silvery sides with a series of brown stripes. Dorsal fin is brown with blue markings.

SIZE: Wild specimens attain a length of 11 inches.

SCIENTIFIC NAME: *Holocentrus scythrops* Jordan and Evermann.

POPULAR NAME: Squirrel Fish.

RANGE: Common in the vicinity of the Hawaiian Islands.

DESCRIPTION: Red above, lighter red on the sides, and white below. Sides are marked with 10 to 12 yellow stripes.

SCIENTIFIC NAME: *Holocentrus tortugae* Jordan and Thompson.

POPULAR NAME: Tortuga Squirrel Fish.

RANGE: Found chiefly in the vicinity of the Tortugas Islands.

DESCRIPTION: Horizontal stripes are more prominent in this species; tail is not as deeply forked, and the dorsal fin carries a black blotch.

SIZE: Wild specimens seldom exceed one foot in length.

SCIENTIFIC NAME: *Holocentrus xantherythrus* Jordan.

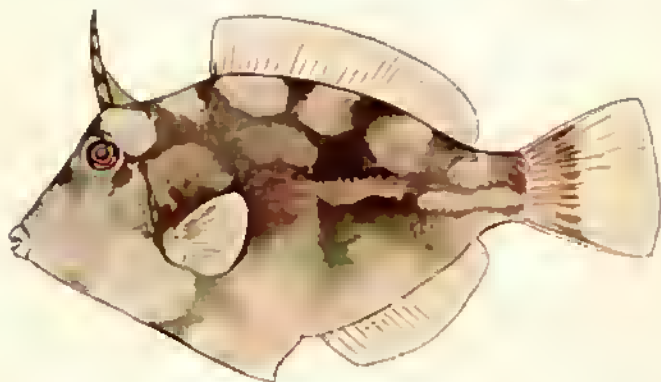
POPULAR NAMES: Alaihi, Alaihi Maoli.

RANGE: Samoa and the Hawaiian Islands; abundant in Hawaii.

DESCRIPTION: Bright red above, silvery below, with about 10 alternating silver and red stripes on the sides.

SIZE: One of the smaller species; a fully grown wild fish attains a length of only 6 inches.

Stephanolepis hispidus, the Common File Fish, is found along the Atlantic Coast of the United States.





Ceratoconthus manoceros, the Unicorn File Fish, occurs in warm waters in both the Atlantic and Pacific Oceans.

Manacanthus tamentasus, the Red-Tailed File Fish, is native to Ceylon. Photo by Dr. Herbert R. Axelrad.



The File Fishes

Family *Monocanthidae*

These fishes resemble the Triggerfishes greatly in body form. One of the differences is the lack of the trigger mechanism. The spiny dorsal fin, instead of being reduced to three or two spines, is still further reduced to only one spine, an exceptionally strong one. The term "File Fish" originated quite a way back when the skin of these fish was used as an abrasive. The File Fish lacks scales and has a shagreen-like texture to its skin, similar to that of sharks.

They are inoffensive little fishes, but may prove a bit difficult to keep. Because of a partly herbivorous nature, they require green food occasionally. Perhaps they could be persuaded to nibble on an occasional spinach or lettuce leaf, in addition to their other diet. There is room for much experimentation here.

SCIENTIFIC NAME: *Ceratacanthus monoceros* Osbeck.

POPULAR NAMES: Unicorn File Fish, Loulou.

RANGE: Cosmopolitan in tropic seas; occurs in warm waters in both the Atlantic and Pacific Oceans.

DESCRIPTION: This File Fish is suitable for an aquarium when small; its body color is a light brown, mottled all over with darker irregular patches.

SIZE: 14 inches.

SCIENTIFIC NAME: *Pervagor spilosoma* Lay and Bennett.

POPULAR NAMES: Fantail File Fish, Oili, Uwiwi, Oeoe.

RANGE: Hawaii and the Leeward Islands.

DESCRIPTION: The body color is yellow, mottled all over with black spots. The head is blue with darker diagonal stripes, and the lips are white. Its real mark of distinction, however, is the tail: fan-shaped, bright red and spotted as well as edged with black; beautiful, and bizarre.

SIZE: 6 inches.

The Trunkfishes

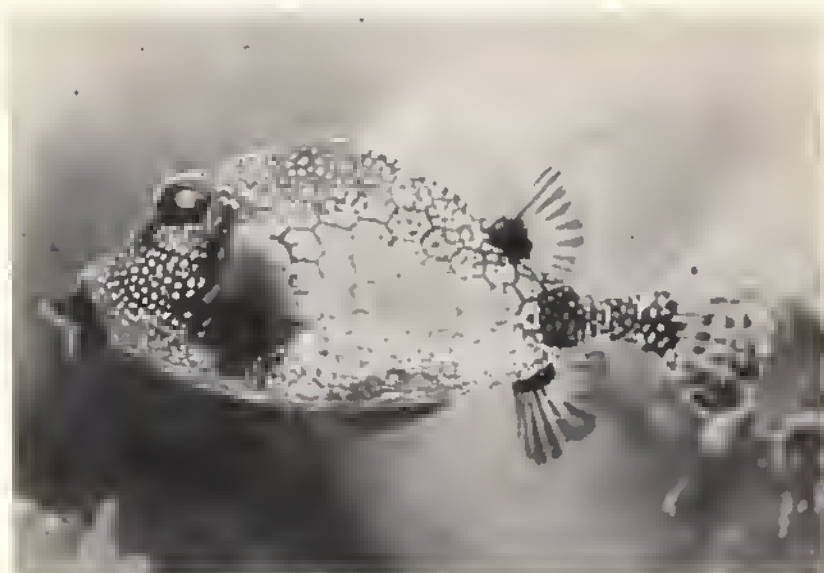
Family *Ostraciidae*

The word "shellfish" might apply to this strange family of fishes as appropriately as to the snails and other mollusks. The Trunkfish's

scales are fused to form a solid shell which covers almost the entire body; the shell is provided with holes through which the movable parts function. Many a larger fish has probably picked one up only to spit it out, thinking it was a rock.

The small fins and rigid body make for very slow and awkward swimming. These fish move somewhat in the manner of the Sea Horses, waving their dorsal and anal fins. The tail is usually used for steering only, and the main job of the pectoral fins is to create a flow of water through the gill openings, which are merely slits in the armor. Some species, such as the Cowfishes, are protected not only by their armor, but also by spines.

This family is known in both the Atlantic and Pacific areas.



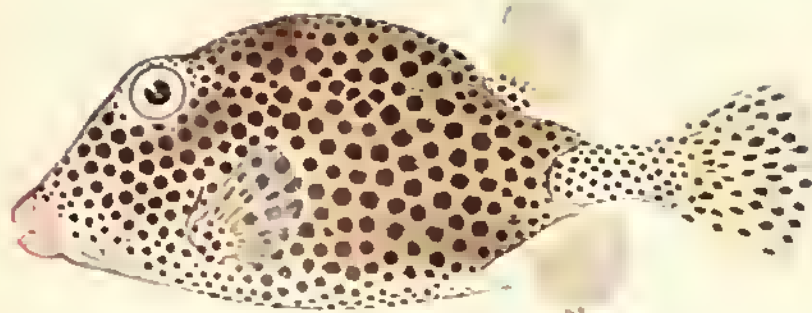
Lactophrys triqueter. The hard shell can be plainly seen on this species, beginning just behind the mouth and ending behind the dorsal and anal fins. Photo by N.Y.Z.S.

SCIENTIFIC NAME: *Lactophrys tricornis* Linnaeus.

POPULAR NAME: Cowfish.

RANGE: Common from Florida north to the Carolinas.

DESCRIPTION: Greatly resembles the *L. trigonus* in color, but the head is armed with two horns, giving it the bovine name and appearance.



Loctophrys bicoudalis, one of the Smooth Trunkfishes.



The Trunkfish, *Loctophrys trigonus*, is numerous in Florido waters.



Because of the two horns and bovine expression, *Loctophrys tricornis* is known as the Cowfish.



These Cowfish, *Lactophrys cornutus*, soon becomes tame enough to accept tidbits from their owner's hands, and they make fascinating acquisitions for the marine tank, especially with their very pleasing color pattern.

SCIENTIFIC NAME: *Lactophrys triqueter* Linnaeus.

POPULAR NAMES: Smooth Trunkfish, Cuckold.

RANGE: Common around Florida and the West Indies; the young are sometimes victims of their poor swimming ability and carried by the Gulf Stream as far north as Massachusetts.

DESCRIPTION: No spines on this one; grayish body covered with spots of a slightly darker color. Dorsal and anal fins yellowish in color.

SIZE: 10 inches.

SCIENTIFIC NAME: *Lactophrys trigonus* Linnaeus.

POPULAR NAMES: Buffalo Trunkfish, Common Trunkfish.

RANGE: Very common in Florida waters.

DESCRIPTION: This Trunkfish differs from the *L. triqueter* by having a slight concavity in the shell behind the head. The color is more attractive, too: green, covered with geometric patterns with dots in the middle.

SIZE: 9 inches.

SCIENTIFIC NAME: *Ostracion cubicus* Linnaeus.

POPULAR NAME: Trunkfish.

RANGE: From the Red Sea throughout the Pacific including Australia.

DESCRIPTION: A uniform dull color, often yellow or mustard color. The body is irregularly covered with circular spots of irregular size. The carapace is spineless. The body is convex in shape while the lower part of the body is very concave.

SCIENTIFIC NAME: *Ostracion fornasini* Bianconi.

POPULAR NAME: Cowfish.

RANGE: Zanzibar, Mozambique, Mauritius, along China and through the East Indies to the Hawaiian Islands.

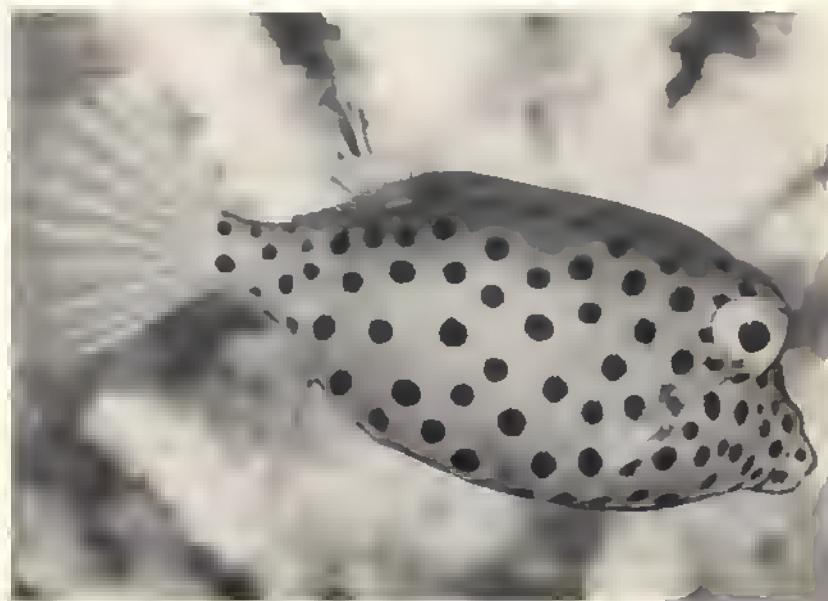
DESCRIPTION: This little Cowfish is covered with irregular geometric designs with dots in the middle. Its armament is formidable: besides the hard shell and the horn over each eye, there is a very substantial spike on its back ahead of the dorsal fin, and a pair just ahead of the anal fin. No doubt many a larger fish has met a nasty death with one of these jammed in its throat.

SIZE: 3 inches.



For the lovers of odd and bizarre fishes, what could be more odd and bizarre than *Ostracion tuberculatus*, a Trunkfish?

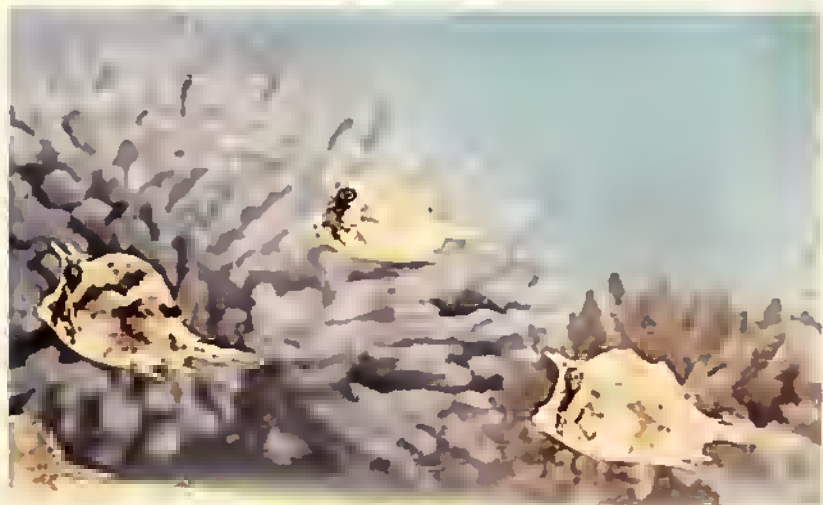
To push about such an ungainly, hard body must require a considerable effort and results in slow swimming, but the Trunkfish is well protected by its hard shell. Both photos by Gerhard Budich.





Another of the Smooth Trunkfishes, *Ostracion cubicus*.

The Four-Horned Cowfish, *Ostracion quadricornis*, has a habit of keeping its caudal fin folded, which adds to its already odd appearance. Photo by Wilhelm Hoppe.





These two little cuties are juvenile specimens of an undetermined *Ostracion* species. Photo by Robert P. L. Stroughan.

No mistaking the distinctive markings of *Ostracion tuberculatus*. Photo by Dr. Herbert R. Axelrod.





Ostracion quadricornis, the Four-Horned Cowfish, comes from the Indo-Pacific.



The interesting and highly unusual spotted pattern of *Ostracion lentiginosum* varies greatly in color. Photo by Gunter Senfft.

SCIENTIFIC NAME: *Ostracion lentiginosum* Bloch.

POPULAR NAME: Boxfish or Trunkfish.

RANGE: Throughout the tropical Indo-Pacific.

DESCRIPTION: A very variable species colorwise. Specimens have been found with brown to green to blue backgrounds; some of the spots are red and some are light pink or white.

SIZE: It grows to about 9 inches in length.

SCIENTIFIC NAME: *Ostracion sebae* Bleeker.

POPULAR NAME: Trunkfish.

RANGE: Zanzibar through the East Indies, Melanesia, Micronesia and Polynesia to the Hawaiian Islands. Sometimes reported off the Mexican coast.

DESCRIPTION: Deep blue, covered with golden and white spots. There is a black area at the tail base, and a vertical bar extends from the forehead through the eye to the throat.

SIZE: 6 inches.

SCIENTIFIC NAME: *Ostracion tuberculatus* Linnaeus.

POPULAR NAME: Spotted Box or Spotted Trunkfish.

RANGE: Throughout the tropical Indo-Pacific.

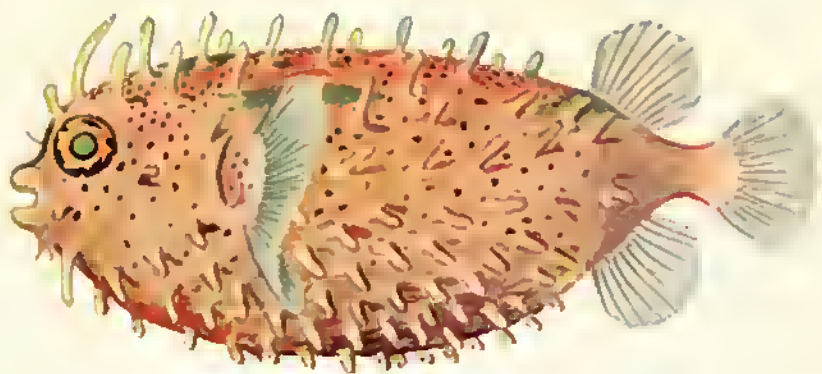
DESCRIPTION: Easily identified by the "tuberculous" spots on the body which change dramatically as the fish gets older. The juvenile stage of this fish has no spots at all, but is checkered with the intersections of the checkers being heavy, dark spots which continue throughout the metamorphosis. It grows to about 10 inches. The color illustration shows a fully grown specimen. When the fish is lifted from the water in a net, it has a strange, not unpleasant odor.



Ostracion sebae, adult form.

Same species, juvenile form.





One of the Spiny Baxfishes, *Chilomycterus antennatus*.

Imagine how a larger fish feels when he tries to swallow a *Diodon hystrix* which has puffed itself up. Photo by Dr. Herbert R. Axelrad.



The Porcupine Fishes

Family *Diodontidae*

Here we have a fish which does not need to worry too much about becoming a meal for its larger brethren. Nature has endowed it with enough protection to ward off its hungriest enemies. Biting into it would be like biting a pin-cushion. It also has the power to inflate itself, which causes the spines to stand out at right angles to the body. The Porcupine Fish is very widely distributed, occurring in all tropical seas. It becomes quite large, but the young ones make very interesting aquarium fish. As their oxygen requirements are rather high, they should not be crowded.

SCIENTIFIC NAME: *Chilomycterus schoepfi* Walbaum.

POPULAR NAME: Spiny Boxfish.

RANGE: Florida. This species is also apt to drift northward in the Gulf Stream. It has been found as far north as Cape Cod.

DESCRIPTION: This fish is not as likely to inflate itself as its cousin, the Porcupine Fish. Its spines are shorter and do not fold back. The upper part of the body is greenish, with a series of undulating lines running back from behind the head. Above the pectoral fins there is an ocellated spot.

SIZE: 10 inches.

SCIENTIFIC NAME: *Diodon hystrix* Linnaeus.

POPULAR NAMES: Porcupine Fish, Oopu Okala.

RANGE: Practically all tropical seas.

DESCRIPTION: Dark mottled brown above, spotted with black. The body is covered with erectile spines, which can inflict a painful wound.

SIZE: 2 feet.

The Frog Fishes

Family *Antennariidae*

The Frog Fishes make an interesting oddity in the aquarium. They are quite hardy, and if provided with the proper foods, will live happily in captivity for a long time.

In their natural state, they often inhabit floating clumps of seaweed, which gives one of them, the Sargassum Fish *Histrio histrio*, a wide range in spite of its being a slow, clumsy swimmer. It parks itself in a clump of Sargassum Weed, and lets the current take it wherever it goes. It is able to assume the colors around it, which gives it perfect camouflage. When a small fish swims into the weed seeking refuge, our friend "goes fishing." This is made possible by a very flexible dorsal spine, which has a little tab on the end. The Sargassum is able to flip this tab in front of its capacious mouth, which of course is open. When the little fish decides to investigate the edibility of this mysterious little tidbit, he suddenly finds himself inside the stomach of a vastly contented Sargassum Fish.

In the aquarium, these fishes will of course prefer to feed on living fishes, which they capture in a surprisingly short time. If you decide to keep other fishes with them, do not make the mistake of giving them a fish the size they can swallow. Also, do not underestimate their swallowing capacity; they can handle a fish almost as large as themselves. Their stomach is capable of considerable stretching, and anything which gets through their mouth finds room below. If you don't feed them live fishes, you will find that the Frog Fishes become quite tame, and can be "hand-fed" with strips of fish dangled in front of their mouths with a pair of tweezers.

SCIENTIFIC NAME: *Antennarius bigibbus* Lacepede.

POPULAR NAME: Frog Fish.

RANGE: Mauritius and Madagascar, through the East Indies, Micronesia and Polynesia to the Hawaiian Islands and the Gulf of California.

DESCRIPTION: Mottled with various colors, mostly brown and gray. The "fishing rod" of this species is a bit longer than the others, reaching almost to the third dorsal spine.

SIZE: $1\frac{1}{2}$ inches.

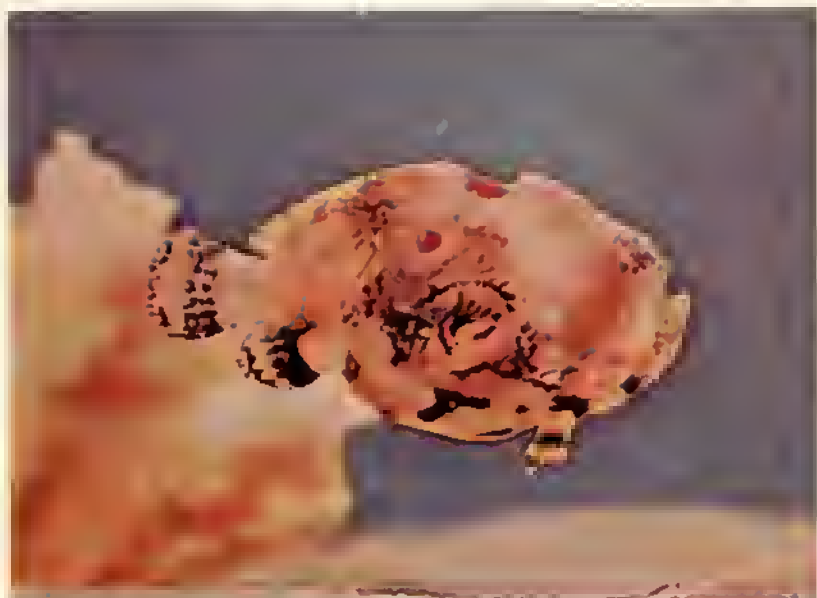
SCIENTIFIC NAME: *Antennarius commersoni* Shaw.

POPULAR NAME: Frog Fish.

RANGE: Zanzibar, Mauritius, the East Indies, along the Queensland coast, through Micronesia and Polynesia to the Hawaiian Islands.

DESCRIPTION: The body of this Frog Fish is a chocolate brown; otherwise it resembles the others.

SIZE: 5 inches.



There are many Frogfishes all over the world. This one, **Antennarius bigibbus**, has a range from Howoii to California and all the way to Madagascor. Photo by Dr. Herbert R. Axelrod.

Antennarius drombus comes from Howoii. Photo by Dr. Herbert R. Axelrod.





The Spiny Boxfish, *Chilomycterus schoepfi*, in a normal swimming position.

Frightened, the Spiny Boxfish puffs itself into a prickly ball.



SCIENTIFIC NAME: *Antennarius leprosus* Eydoux and Souleyet.

POPULAR NAME: Frog Fish.

RANGE: Known as from the Hawaiian Islands and from Woodlark Island in the Coral Sea.

DESCRIPTION: This fish has a rough skin, and is covered with black spots.

SIZE: 6 inches.

SCIENTIFIC NAME: *Antennarius nexilis* Snyder.

POPULAR NAME: Frog Fish.

RANGE: Southern Polynesian and the Hawaiian Islands.

DESCRIPTION: The skin of this Frog Fish is prickly and rough. The color is brown, marked with deeper spots, and the fins have dark mottlings.

SIZE: 2 inches.

SCIENTIFIC NAME: *Antennarius muninifer* Cuvier.

POPULAR NAME: Frog Fish.

RANGE: Red Sea through the East Indies, Micronesia and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: This little fish is dark above, and lighter below. The body is covered with large, dark, round spots.

SIZE: 2 inches.

SCIENTIFIC NAME: *Histrio gibbus* Mitchill.

POPULAR NAME: Common Frog Fish.

RANGE: West Indies north to Key West.

DESCRIPTION: Very similar to *H. histrio*, except that the body is a bit more slender, and the fins and tail are marked with dark streaks.

SIZE: 3 inches.

SCIENTIFIC NAME: *Histrio hispidus* Schneider.

POPULAR NAME: Frog Fish.

RANGE: From India through the East Indies, Melanesia and Polynesia as far as the Hawaiian Islands.

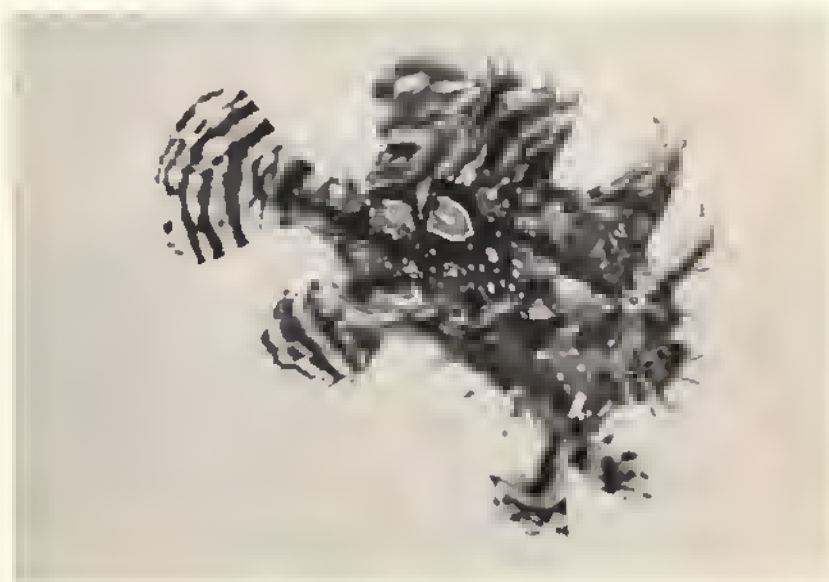
DESCRIPTION: The skin of this Frog Fish is not smooth, but rough and prickly. Body color is dark, with lighter mottling.

SIZE: 7 inches.



Puzzle: find the fish! Most of the Anglerfishes lie on the bottom and imitate rocks, but the Sargassum Fish represents a remarkable adaptation by Nature to blend in the background. N.Y.Z.S. Photo.

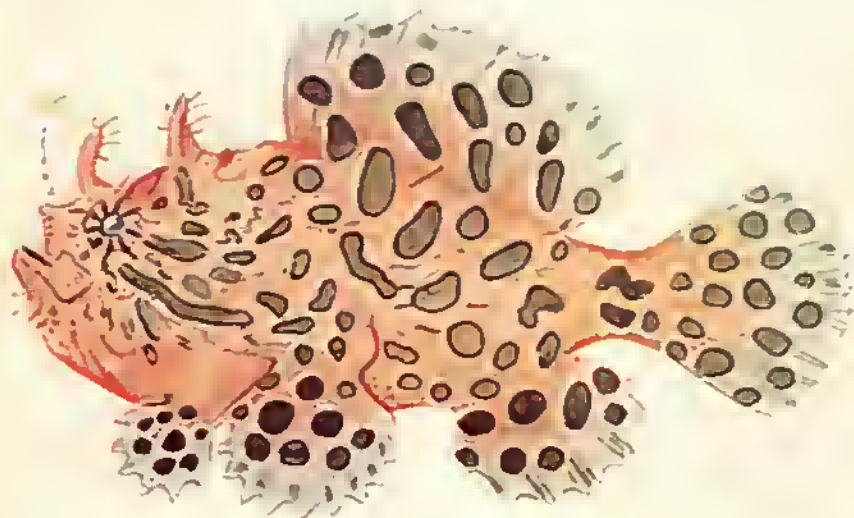
Taken out of its surroundings, the Sargassum Fish still looks like a bundle of seaweed. N.Y.Z.S. Photo.





Antennarius cammersani is a Philippine species which manages to find plants of the same color. Photo by Gene Wolfsheimer.

Note the "fishing rod" just behind the upper lip of **Antennarius scaber**. This is waved in front of the fish's mouth to attract smaller fishes.

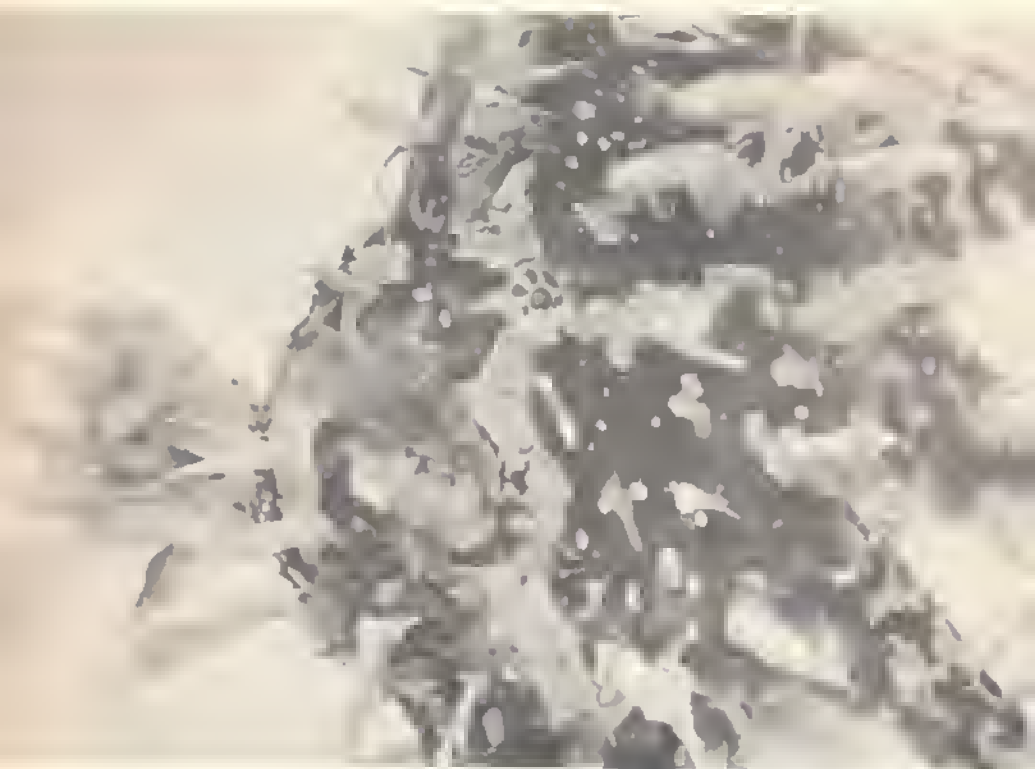




Antennarius nuttingi. Note how the pectorol fins ore on o jointed elongotion which resembles a short "leg" and permits the fish to woddle along the bottom.

Another Sargossum Fish species, **Histrio histrio**. These fishes ore very uncomfortable when taken out of their Sargossum weed hiding ploces.
Photo by Dr. Herbert R. Axelrod.





Head of *Histrio histrio*, showing the numerous fleshy tabs which wave in the current and make it look like seaweed. The tip of the "fishing rod" looks like food to another fish and is tilted forward to wave over the mouth. Photo by Dr. Herbert R. Axelrod.

SCIENTIFIC NAME: *Histrio histrio* Linnaeus.

POPULAR NAMES: Sargassum Fish, Frog Fish.

RANGE: Found in all tropical seas all over the world.

DESCRIPTION: Color is changeable; it can match its surroundings easily. The body is scaleless; the first ray of the dorsal fin has the characteristic tab on the end which is waved in front of the open mouth to attract smaller fishes. Another peculiar characteristic of these and the other members of the family is the fact that the pectoral and dorsal fins are mounted on arm-like extensions, permitting them to climb in a very froglike manner through the weeds which are their home.

SIZE: 6 inches.



Antennarius scaber, a Florida species, has a really odd wormlike attachment on its "fishing rod." Here we see it in action, N.Y.Z.S. Photo.

Here an Anglerfish has grobbed its prey. From the bulge of its belly, it looks as if many more have preceded it. Photo by Kurt Severin.





The *Heniochus* species are very popular because of their attractive colors, their perky behavior and hardiness in the aquarium. Photo by Dr. Herbert R. Axelrad.



The fabulous Moorish Idol, *Zanclus cornutus*. Unfortunately, they are a bit delicate in the aquarium, and shipping them, as well as keeping them alive, is difficult. The result is an expensive fish, but a very desirable one. Photo by Dr. Herbert R. Axelrod.

The Moorish Idol Family

Family *Zanclidae*

These are probably the most fantastically shaped and colored of all aquarium fishes. Their oddly shaped bodies, as well as their bold color design have captured the fancy of many artists and designers. We have often seen them pictured, although not so many of us have been privileged to admire the living ones. They are closely related to the Angelfishes.



The high, prominent first dorsal rays are frequently a target for the nips of other fishes. These grow back very rapidly but sometimes remain a bit crooked. Photo by Dr. Herbert R. Axelrod.

SCIENTIFIC NAME: *Zanclus cornutus* Linnaeus.

POPULAR NAMES: Moorish Idol, Kihikihi Loulou.

RANGE: Zanzibar and Mauritius through the Indian Ocean, the East Indies, Melanesia, Micronesia and Polynesia, the Japanese coast, and even to the islands off the Mexican coast.

DESCRIPTION: The body is short and high, greatly compressed. The anal fin is deep, but the dorsal fin is the startling feature. It is high, and the first rays are greatly elongated, trailing far behind the tail. The snout is long, and there is a prominent horn in front of each eye. As for colors, the upper part of the snout is orange, and the

lower black. There is a black area just behind this, with a yellow triangular marking. A yellow bar, edged with blue, extends from the horn to the throat. Behind this, extending from the first rays of the dorsal fin through the region just behind the pectoral fin to the belly is a black band which is adorned with three deep blue wavy lines. Behind this is a yellow area which extends across the body as far as the short dorsal rays and about the fifth anal ray. Then comes another narrower black bar, edged with blue posteriorly. The tail base is yellow, and the tail itself is black, edged anteriorly with a narrow white bar and posteriorly with blue and yellow.

SIZE: About 7 inches.

SCIENTIFIC NAME: *Zanclus canescens* Linnaeus.

POPULAR NAME: Moorish Idol.

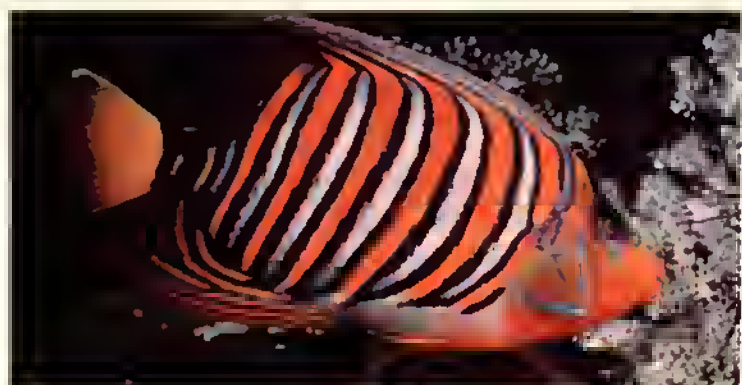
RANGE: Same wide distribution as *Zanclus cornutus*.

DESCRIPTION: Body shape is similar to the former, but the horns are absent. The colors are deep brown in the black regions of the former, and the yellow areas are lighter brown. There is a great deal of speculation among ichthyologists as to whether this is a mature form of *Z. cornutus*; there is of course a possibility that the horns are shed as the fish grows older.

SIZE: About 12 inches.

The two species of *Zanclus* given here are listed primarily for convenience in identification within the trade; *Zanclus cornutus* and *canescens* are undoubtedly the same species, regardless of whether the preorbital spine, or horn, is present. One fish is merely a juvenile stage, not a different species. Photo by Wilhelm Hoppe.





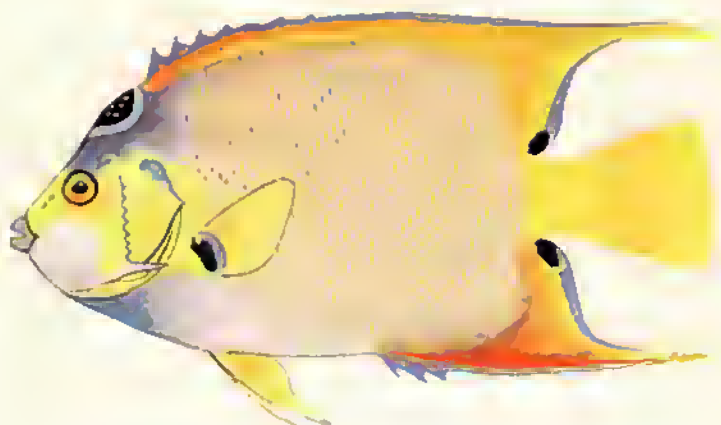
Pygoplites diacanthus. This beauty comes from the tropical Indo-Pacific region. Photo by Hans and Klaus Paysan.

The Butterfly and Angel Fishes

Family *Chaetodontidae*

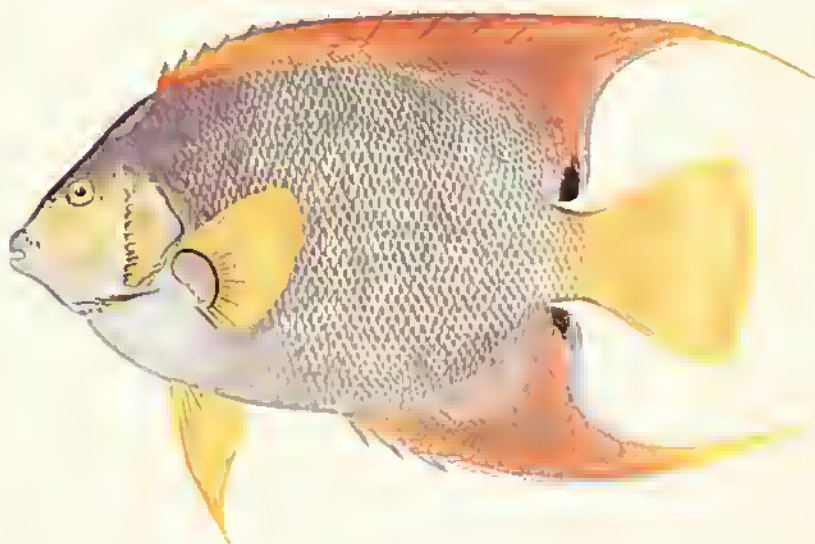
This family includes some of the most beautiful of all aquarium fishes. Not only are they graceful in form and movement, but their colors are also among the most brilliant of all the fishes. The Butterfly Fishes have a compressed, disc-shaped body, with short fins. They display much yellow and brown in coloration, and the most beautiful species are native to Pacific waters. They are apt to be a bit temperamental as far as food is concerned, and may insist on live brine shrimp. They may be carefully weaned to other foods by feeding them white worms or small earthworms.

The Angelfishes of the Atlantic are characterized by their compressed bodies and flowing dorsal and anal fins. They are very beautiful, but great care should be taken when putting them in a tank together. It has been found that individuals get along better with each other if the sizes are mixed. If two Angelfish of exactly the same size are put together, a fight might ensue which could be fatal for one. These fish have a sharp spike on the gill-plate which can be used very effectively on an adversary. Even when very young, they know how to use this weapon. Hiding places should be generously provided.



The Queen Angelfish is a beautiful and highly prized aquarium fish when young.

The Blue Angelfish is also highly prized in its smaller sizes.



SCIENTIFIC NAME: *Angelichthys ciliaris* Linnaeus.

POPULAR NAME: Queen Angelfish.

RANGE: West Indies to Florida.

DESCRIPTION: A blue and yellow fish, with beautiful golden fins edged with blue. There is a dark blue ocellus or ring atop the head; its resemblance to a crown gives it its popular name.

SIZE: Attains 2 feet in length.

SCIENTIFIC NAME: *Angelichthys isabelita* Jordan and Ritter.

POPULAR NAMES: Common Angelfish, Blue Angelfish.

RANGE: West Indies, Florida and Bermuda.

DESCRIPTION: Young specimens are almost a duplicate of the Queen Angelfish, but the Queen is orange where the Blue Angelfish is only yellow. At maturity the Blue may be distinguished by the lack of the ocellus; besides, the fins of the Queen are orange-yellow, and those of the Blue have only a yellow band.

SIZE: About 18 inches at maturity.

SCIENTIFIC NAME: *Angelichthys townsendi* Nichols and Mowbray.

POPULAR NAME: Townsend's Angelfish.

RANGE: Florida Keys.

DESCRIPTION: Greatly resembles the Queen Angelfish, but the ocellus at the top of the head is missing. Pectoral fins and tail are bright lemon yellow.

SIZE: 1 foot at maturity.

SCIENTIFIC NAME: *Centropyge bicolor* Bloch.

POPULAR NAMES: Angelfish, Vaqueta de Dos Colores, Rock Beauty.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The anterior half of the body is golden, the posterior half black, and the tail golden. There is a wide black patch on the forehead.

SIZE: About 4 inches.

SCIENTIFIC NAME: *Centropyge bispinosus* Gunther.

POPULAR NAME: Angelfish.

RANGE: Melanesia and Polynesia.

DESCRIPTION: Body light brown, fins darker. About 20 narrow

vertical lines adorn the sides.

SIZE: About 8 inches.

SCIENTIFIC NAME: *Centropyge fisheri* Snyder.

POPULAR NAMES: Fisher's Angelfish, Kole.

RANGE: Hawaiian Islands.

DESCRIPTION: Bright orange, with a dark bluish patch on the back below the dorsal fin.

SIZE: 3 inches.

SCIENTIFIC NAME: *Centropyge potteri* Jordan and Metz.

POPULAR NAME: Thorny-eyed Butterfly Fish.

RANGE: Tropical central Indo-Pacific.

DESCRIPTION: A very small (under four inches) Butterfly Fish which is found in shallow waters but has deep sea protection in the fact that it has a preopercular spine. No other fish from shallow waters is known to have this "equipment."

SCIENTIFIC NAME: *Chaetodon auriga* Forskal.

POPULAR NAME: Butterfly Fish.

RANGE: Red Sea eastward through the East Indies, Melanesia, Micronesia and Polynesia, northward to the Hawaiian Islands.

DESCRIPTION: The snout of this species is somewhat elongated. Body is light yellow, with narrow diagonal bars running upward and downward from a point near the center of the body. A dark vertical bar runs from the forehead to the throat, passing through the eye; this bar is wider below than above. The posterior end of the dorsal fin carries a large dark spot, and the fifth soft dorsal ray is elongated to extend beyond the tail.

SIZE: Attains a maximum of 8 inches.

SCIENTIFIC NAME: *Chaetodon bennetti* Cuvier.

POPULAR NAME: Butterfly Fish.

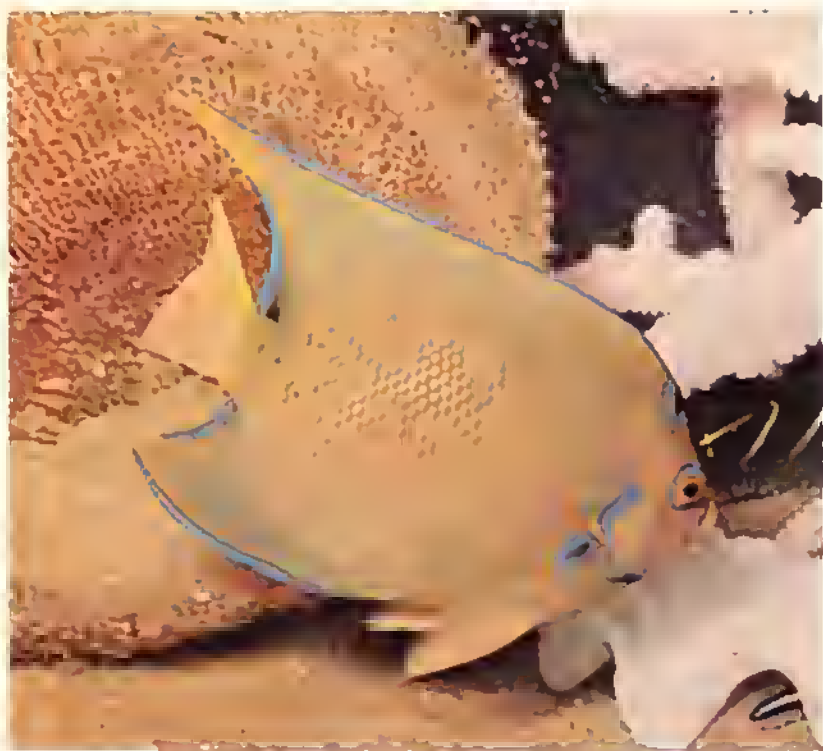
RANGE: East Indies.

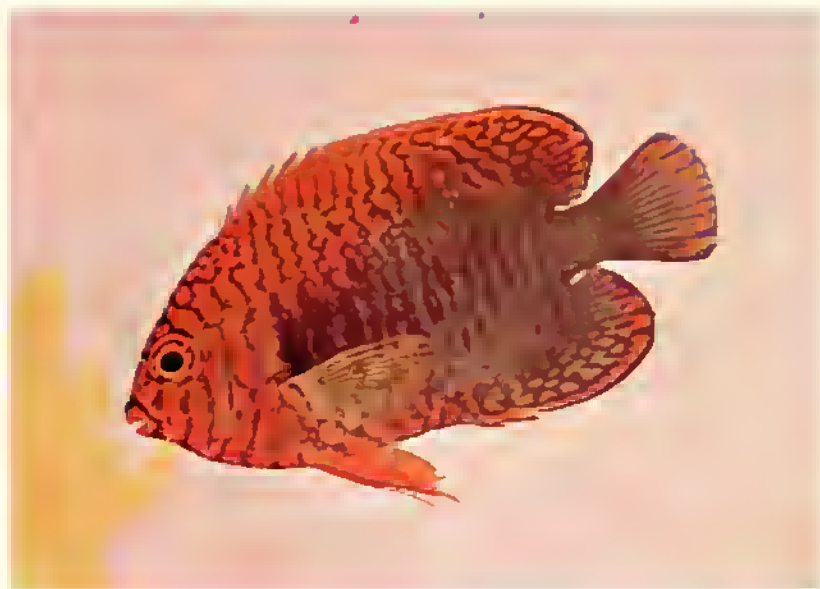
DESCRIPTION: A strikingly beautiful fish; the ground color is bright yellow. A purple band passes through the eye; this band is edged with light blue. A dark purple spot, also edged with blue, and the base of the dorsal and anal fins, as well as the tail base, are bright orange. An orange bar passes through the center of the tail fin. The



Blue Angelfish. Photo by Dr. Herbert R. Axelrod.

Townsend's Angelfish, *Angelichthys townsendi*, is by far the rarest of the Angels. Photo by Robert P. L. Straughan.





Centropyge pateri, from the Indo-Pacific. Photo by Gene Wolfsheimer.

Chaetodon auriga has an unusual pattern of lines, and is a very beautiful aquarium fish. Photo by Dr. Herbert R. Axelrad.



outstanding characteristic, however, is a pair of flowing bright blue lines which pass downward into the body toward the anal fin.

SIZE: About 5 inches at maturity.

SCIENTIFIC NAME: *Chaetodon capistratus* Linnaeus.

POPULAR NAME: Four-eyed Butterfly Fish.

RANGE: West Indies, common in southern Florida.

DESCRIPTION: Also resembles the preceding two, with the exception of a large dark round ocellated spot near the tail base. Because this spot somewhat resembles an extra eye, the fish got its popular name. There are also about 20 fine dark lines which extend diagonally from the dorsal fin towards the center of the body, to be met by another similar set of diagonal lines from below.

SCIENTIFIC NAME: *Chaetodon chrysurus* Desjardins.

POPULAR NAME: African Butterfly Fish.

RANGE: Throughout the central Indo-Pacific. Also found in Africa on the east coast.

DESCRIPTION: A very beautiful, though rare species, that grows to a maximum of about 6 inches. It takes on various colors depending upon the reef from which it comes, the temperature of the water and the amount of frozen brine shrimp that is offered it. The more shrimp, the stronger the colors.

SCIENTIFIC NAME: *Chaetodon collaris* Day.

POPULAR NAME: Pakistani Butterfly Fish.

RANGE: The reefs on the western coast of Pakistan and adjacent waters.

DESCRIPTION: A very colorful and distinct species found in an area that is pitifully poor in Chaetodons. This species was photographed by the author (HRA) in Karachi, Pakistan after having been collected by the local fisheries department for a collection of their fishes to be displayed in the new aquarium erected in 1961. The Director of the Aquarium, Maqsood-ul-Hasan, has designed and constructed one of the most beautiful aquariums in the Middle East. Aquarists in that area are encouraged to visit the Aquarium.

SCIENTIFIC NAME: *Chaetodon ephippium* Cuvier.

POPULAR NAME: Butterfly Fish.

RANGE: East Indies.

DESCRIPTION: Body color light yellow above, gray below. This species is easily identified by a large, deep red spot which extends from the soft dorsal fin almost half-way into the body. This spot is edged with white on the body side, and with orange and blue where it is part of the dorsal fin. The first soft ray of the dorsal is elongated into a filament which extends slightly beyond the tail. There is a series of narrow silvery horizontal stripes across the lower half of the body. The characteristic vertical bar on the head which passes through the eye is almost absent in the adult form of this species.

SCIENTIFIC NAME: *Chaetodon falcula* Bloch.

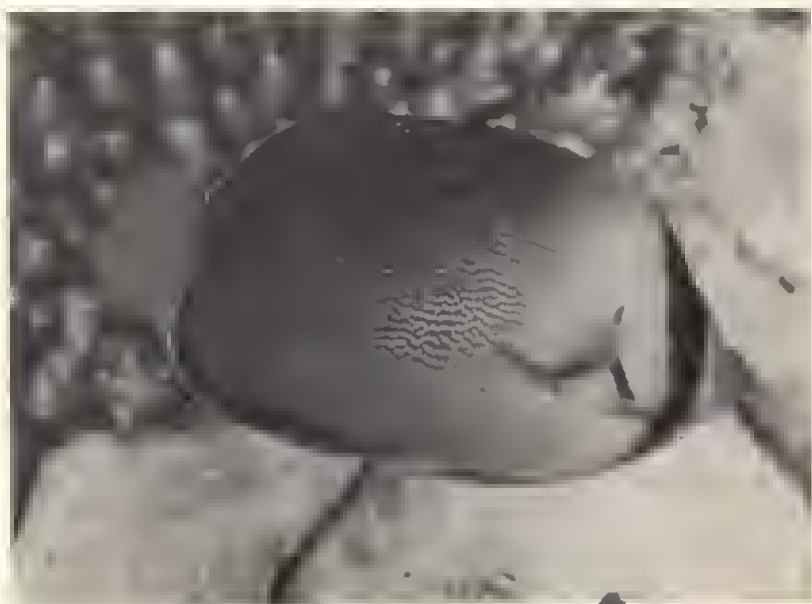
POPULAR NAME: Butterfly Fish.

RANGE: Micronesia, Polynesia, Marshall Islands.

DESCRIPTION: Elongated snout; yellow in color, with a wide bar through the eye, a large dark area extending from the first rays of the dorsal fin down to the middle of the body, and another dark patch extending from the soft rays of the dorsal fin to approximately the same depth.

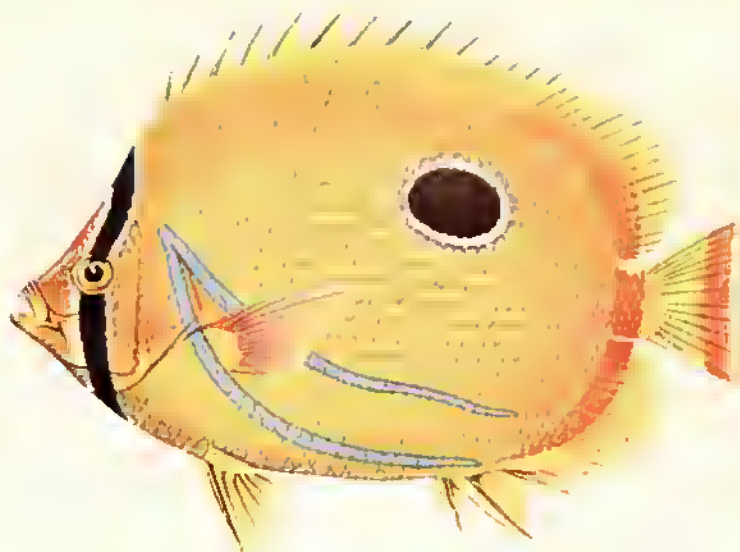
SIZE: About 5 inches at maturity.

Chaetodontoplus mesoleucus. Photo by Gerhard Budich.



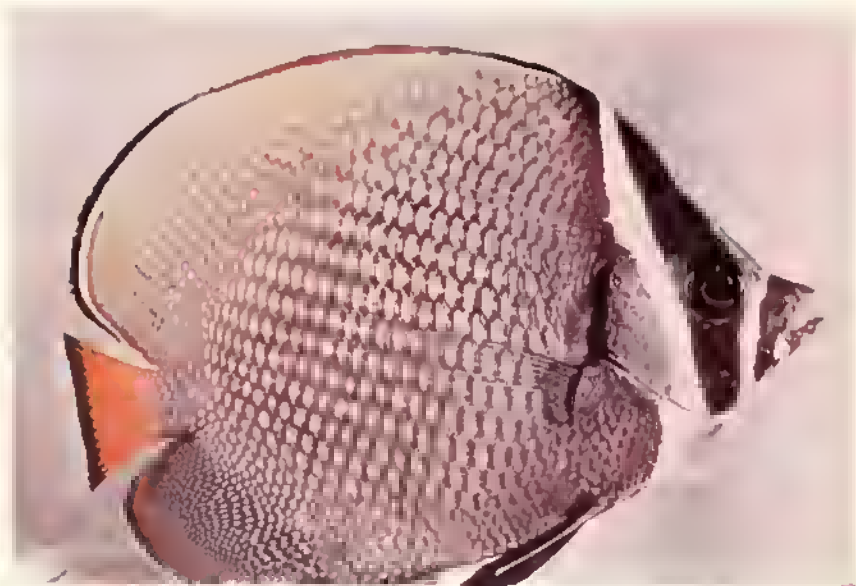


The Four-Eyed Butterfly Fish, *Chaetodon capistratus*, is one of the most common of the Florida Coralfishes. This is a young specimen. Photo by Dr. Herbert R. Axelrod.



Chaetodon bennetti is a handsome, easily-recognized fish.

A great many Butterfly Fishes run to yellows and browns, but **Chaetodon collaris** is a beautiful exception, and a hardy aquarium fish as well. Photo by Dr. Herbert R. Axelrod.



SCIENTIFIC NAME: *Chaetodon fremblii* Bennett.

POPULAR NAMES: Blue-lined Butterfly Fish, Lauhau, Kikakapu, Kapuhili.

RANGE: Known only as from the Hawaiian Islands.

DESCRIPTION: Pale yellow, with eight bright blue lines along the body. There is a large black spot just above the top of the head, and another at the base of the tail.

SIZE: About 5 inches at maturity.

SCIENTIFIC NAME: *Chaetodon kleini* Bloch.

POPULAR NAME: Butterfly Fish.

RANGE: East Indies.

DESCRIPTION: Anterior part of body yellow, with two wide dark bands, one passing through the eye and the other through the pectoral region. Posterior half of the body is purplish, and each scale in this region carries a bright red dot.

SIZE: About 5 inches at maturity.

SCIENTIFIC NAME: *Chaetodon lineolatus* Cuvier.

POPULAR NAME: Butterfly Fish.

RANGE: East Indies.

DESCRIPTION: A long-snouted species; body is orange above, and yellow below. A wide dark bar passes through the eye, and there is a wide, crescent-shaped marking which passes from the base of the soft dorsal fin through the tail base into the anal fin, narrowing as it descends. There are about 20 narrow vertical bars, and two near the edge of the tail fin.

SIZE: About 6 inches at maturity.

SCIENTIFIC NAME: *Chaetodon lunula* Lacepede.

POPULAR NAMES: Kikakapu, Kapuhili, Lauhau.

RANGE: From the Red Sea through the East Indies, through Melanesia, Micronesia and the Hawaiian Islands. Common in Samoa.

DESCRIPTION: Yellowish olive, with a wide stripe running through the eye, and another on the shoulder.

SIZE: 7 inches at maturity.

SCIENTIFIC NAME: *Chaetodon melanotus* Bloch and Schneider.

POPULAR NAME: Butterfly Fish.

RANGE: East Indies.

DESCRIPTION: Upper part of body deep red, with two yellow spots above and an oblong marking below; lower part of the body yellow. The entire body is covered with rows of dots, running upwards toward the posterior end. Tail is divided in half by an orange bar; the inner half of the tail is yellow, and the outer half bright blue.

SIZE: About 5 inches at maturity.

SCIENTIFIC NAME: *Chaetodon mertensi* Cuvier.

POPULAR NAME: Butterfly Fish.

RANGE: Throughout the central Indo-Pacific.

DESCRIPTION: This is a very similar fish to *C. xanthurus* and *C. chrysurus*. The main color differences are that the nuchal spot is sharp and clear and is margined in white, distinctly outlining its inverted horseshoe-shape in *chrysurus*; this species does not show the regularity of marking on the nape and does not have the white outline highlighting it. Then, too, *chrysurus* has at least 14 chevron-like markings, while *mertensi* has not more than 10.

SCIENTIFIC NAME: *Chaetodon meyeri* Bloch and Schneider.

POPULAR NAME: Butterfly Fish.

RANGE: Known only from the area from the Marshall Islands to the East Indies.

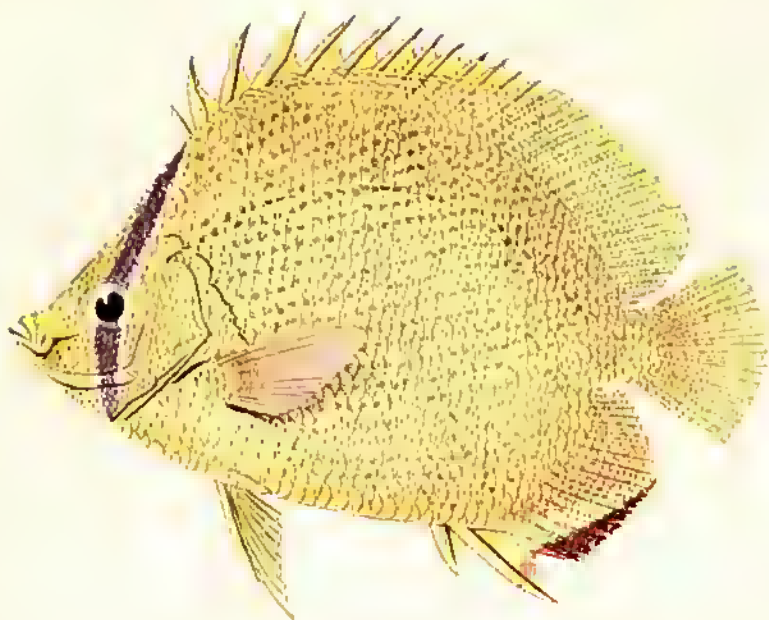
DESCRIPTION: This beautiful specimen is one of the most highly marked species of this, the most beautiful genus of fishes known. The illustration shows a very young specimen with juvenile markings. It is a real prize for the aquarist and is one of the highest priced Butterfly Fish.

SCIENTIFIC NAME: *Chaetodon miliaris* Quoy and Gaimard.

POPULAR NAME: Butterfly Fish.

RANGE: Throughout the central Indo-Pacific.

DESCRIPTION: The illustration shown here serves a noble purpose, for it shows the ideal specimen, drawn by a professional artist and scientifically accurate (even each scale on its body has been measured and counted).



Chaetodon miliaris, from an old drawing.

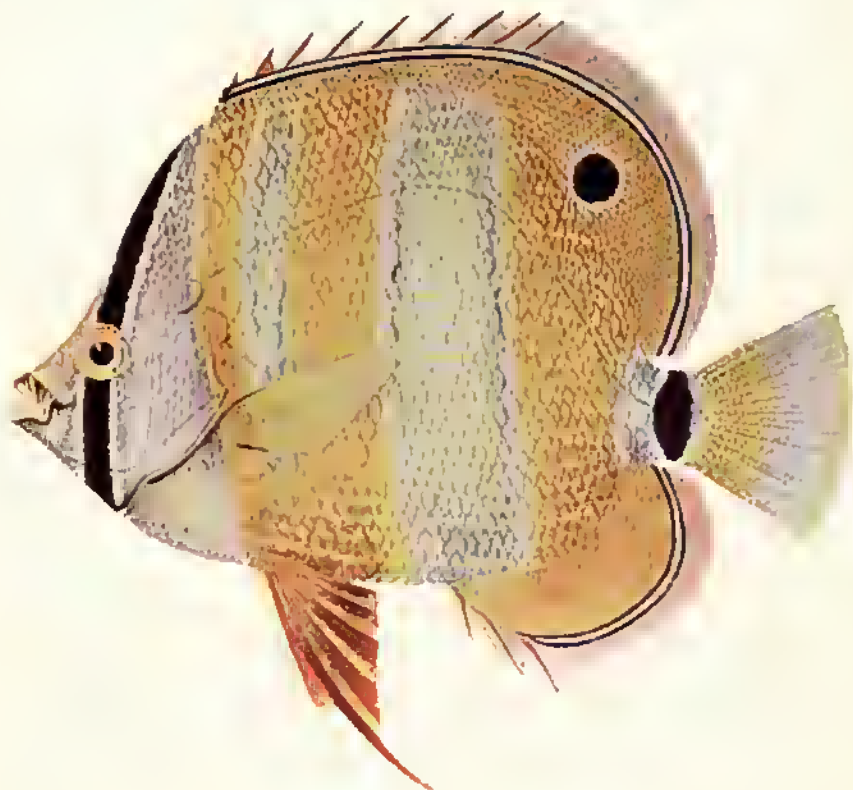
Underwater photograph of an Indo-Pacific coral reef.
Photo by Rodney Jonklaas.





Chaetodon citrinellus. Photo by Wilhelm Hoppe.

The circular ocellated spot in the soft part of the dorsal fin is a mark of *Chaetodon chrysurus*.



SCIENTIFIC NAME: *Chaetodon ocellatus* Bloch.

POPULAR NAME: Common Butterfly Fish.

RANGE: West Indies and the Florida coast.

DESCRIPTION: Yellow, with a dark band running from the base of the first dorsal fin through the eye to the throat; large dark spot at the base of the second dorsal fin.

SCIENTIFIC NAME: *Chaetodon ornatissimus* Cuvier.

POPULAR NAMES: Butterfly Fish, Kikikapu, Lauhau.

RANGE: East Indies through Melanesia and Micronesia to Hawaii.

DESCRIPTION: One of the most beautiful Butterfly Fishes. The body is bright yellow, ornamented with seven oblique dark brown stripes. The head is ornamented with the usual dark stripe through the eye, plus a few smaller stripes and a dark area around the mouth. The tail is a startling rosy pink, with two vertical dark stripes.

SIZE: About 6 inches at maturity.

SCIENTIFIC NAME: *Chaetodon punctato-fasciatus* Cuvier.

POPULAR NAME: Butterfly Fish.

RANGE: Throughout the East Indies, Melanesia, and Micronesia as far north as the Hawaiian Islands.

DESCRIPTION: Light yellow above, silvery gray below; the upper part of the body is adorned with 6 vertical bars, and horizontal rows of round dots cover the lower part. There is a small reddish area at the tail base, and a vertical bar extends through the tail fin.

SIZE: 4 inches.

SCIENTIFIC NAME: *Chaetodon quadrimaculatus* Gray.

POPULAR NAMES: Lauhau, Four-spotted Butterfly Fish.

RANGE: Polynesia and the Hawaiian Islands.

DESCRIPTION: Dark gray above and silvery below. There are two light spots in the dark area, and a golden stripe, edged with black, runs vertically through the eye.

SIZE: About 5 inches.

SCIENTIFIC NAME: *Chaetodon reticulatus* Cuvier.

POPULAR NAME: Reticulated Butterfly Fish.

RANGE: From India, along the coast of China, through the East Indies, Micronesia, Japan and the Hawaiian Islands.

DESCRIPTION: There is a broad black band bordered with yellow running through the eye. The body is black, and each scale has a small light area in the middle. The breast area is bright yellow.

SIZE: About 6 inches at maturity.

SCIENTIFIC NAME: *Chaetodon semeion* Bleeker.

POPULAR NAME: Butterfly Fish.

RANGE: East Indies.

DESCRIPTION: Snout slightly elongated, body yellow with dark brown band through the eye, and another in the dorsal and anal fins. First spine of the soft dorsal elongated in a filament which reaches as far as the tip of the tail. Each scale carries a small black dot in the center.

SIZE: About 6 inches at maturity.

SCIENTIFIC NAME: *Chaetodon setifer* Bloch.

POPULAR NAMES: Kikakapu, Lauhau.

RANGE: Widely distributed, from the Red Sea and Zanzibar through the East Indies, along Queensland, through Micronesia, Melanesia and Polynesia as far as the Hawaiian Islands. Common in Samoa.

DESCRIPTION: Light violet in front and below, with the usual dark stripe through the eye. The upper rear part of the body is yellow, and there is a dark spot in the posterior portion of the dorsal fin. This is another species with an elongated snout.

SIZE: Attains a maximum of 8 inches.

SCIENTIFIC NAME: *Chaetodon striatus* Linnaeus.

POPULAR NAME: Banded Butterfly Fish.

RANGE: West Indies, sometimes found in Florida.

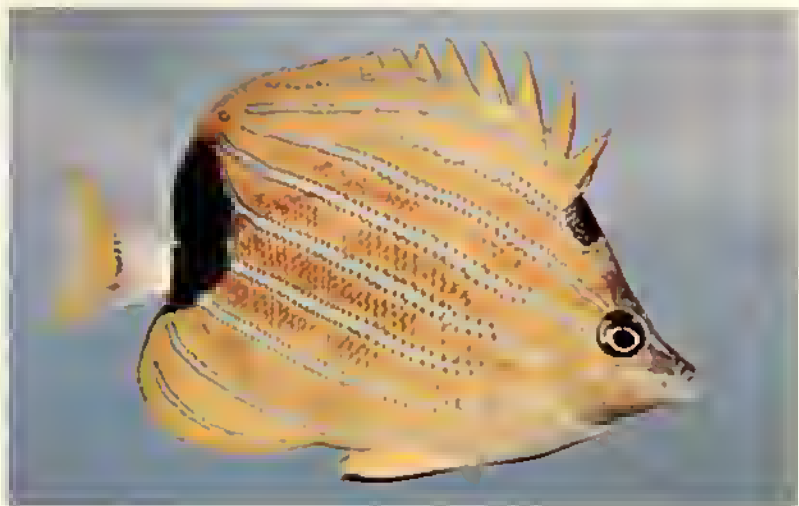
DESCRIPTION: Resembles the former, but has several dark vertical bars.

SIZE: 6 inches when mature.

SCIENTIFIC NAME: *Chaetodon trifasciatus* Mungo Park.

POPULAR NAME: Kapuhili.

RANGE: Very widely distributed throughout the Pacific and Indian Oceans as far as the Red Sea.



Choetodon fremblii, a young specimen. Photo by Dr. Herbert R. Axelrod.

Chaetodon ephippium is easily identified by the large reddish marking in the rear dorsal area. Photo by Earl Kennedy.





One of the most beautiful of the Butterfly Fishes is **Chaetodon lunula**.
Photo by Dr. Herbert R. Axelrod.

Chaetodon lineolatus, in addition to the fine vertical bars, has a
"mask" that covers most of its face.



DESCRIPTION: The body of this fish has an oval shape. It is pale yellow in color, and has the typical dark stripe through the eye, followed by a narrower stripe which extends from the third dorsal spine through the opercle just behind the eye. There is a dark area just below the second dorsal fin, and another in the anal fin, while a third extends vertically through the center of the tail.

SIZE: About 6 inches at maturity.

SCIENTIFIC NAME: *Chaetodon unimaculatus* Bloch.

POPULAR NAMES: Kikakapu, Lauhau.

RANGE: From Madagascar and Zanzibar through Ceylon, the East Indies, Melanesia and Polynesia, north to the Hawaiian Islands.

DESCRIPTION: The outstanding characteristic of this fish is a large round dark spot just above the center of the body. It is edged with white, making it still more prominent. A dark vertical bar passes through the eye, and another through the posterior edge of the dorsal and anal fins.

SIZE: About 5 inches at maturity.

SCIENTIFIC NAME: *Chaetodon vagabundus* Linnaeus.

POPULAR NAME: Butterfly Fish.

RANGE: East Indies.

DESCRIPTION: Body color yellow, darker above and lighter below. A purple stripe passes through the eye, and a purple crescent-shaped stripe extends through the soft dorsal fin across the tail base and into the anal fin. The oddity in this fish's marking is in the set of narrow diagonal bars which adorn the sides: 6 travel diagonally upward from the upper half of the opercle into the dorsal fin; the lowest of these bars is the starting point for about 15 other bars which travel downward at right angles to the others. The tail fin carries a vertical purple bar, and is edged with purple.

SIZE: About 5 inches at maturity.

SCIENTIFIC NAME: *Chaetodon xanthurus* Bleeker.

POPULAR NAME: Butterfly Fish.

RANGE: Throughout the central Indo-Pacific.

DESCRIPTION: This fish is often mistaken for the African Butterfly Fish, *Chaetodon chrysurus*. Immature specimens look very much

alike, but the adults differ significantly in the heavy markings found on the caudal peduncle. Even large specimens of *C. chrysurus* have the peduncular marking, while specimens five inches and larger of *xanthurus* have all lost traces of the juvenile mark. This species grows to about six inches.

SCIENTIFIC NAME: *Holocanthus tricolor* Bloch.

POPULAR NAME: Rock Beauty.

RANGE: West Indies to Florida.

DESCRIPTION: This is probably the most beautiful of the Florida fishes. Young specimens are bright orange in color, with a large black spot on the back. This spot is ringed with bright blue, as is the eye. As the fish grows up, the black spot spreads until it becomes a large saddle, and the blue circle gradually disappears. The dorsal and anal fins become suffused with red and edged with black. The rays of the dorsal and anal fin are slightly elongated, as well as the top and bottom of the tail fin.

SIZE: Attains a length of almost 2 feet.

The very attractive Rock Beauty, *Holoconthus tricolor*, from Florida, eventually gets too big for the average aquarium, but young specimens are very pretty. Photo by Wilhelm Hoppe.

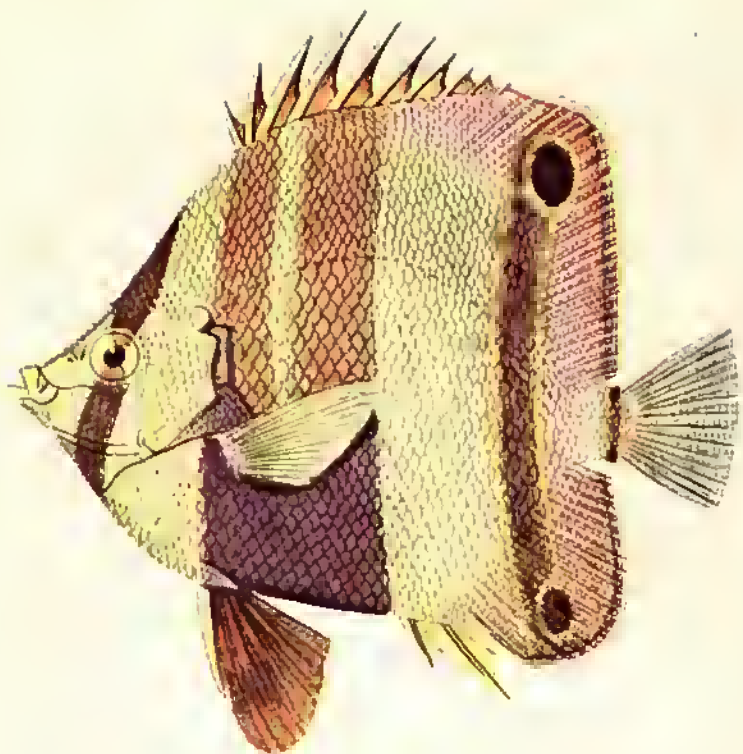




Chaetodon melonotus has diagonal stripes that slant forward. Photo by Dr. Herbert R. Axelrod.

Very similar is **Chaetodon mertensi**, but there is a herringbone pattern on the sides. Photo by Dr. Herbert R. Axelrod.





The name of this **Chaetodon melanopus** and the name of the **C. melanotus** appearing opposite could easily be confused, but the fishes themselves are quite different.

Chaetodon meyeri in its juvenile colors. Photo by Earl Kennedy.



SCIENTIFIC NAME: *Megaprotodon strigangulus* Gmelin.

POPULAR NAME: Butterfly Fish.

RANGE: East Indies.

DESCRIPTION: Body is short and high, pale yellow above and paler below. A dark bar runs through the eyes, and a double bar of light purple runs from the dorsal fin to the center of the body. These bars join at this point to become a single wide bar of deep purple. Two large dark spots appear anteriorly, one at the top of the dorsal fin, and the other at the bottom of the anal fin. These are joined with a purple bar, edged with deep yellow.

Size: About 4 inches at maturity.

SCIENTIFIC NAME: *Parachaetodon ocellatus* Bloch.

POPULAR NAME: Butterfly Fish.

RANGE: East Indies.

DESCRIPTION: Do not confuse this fish with *Chaetodon ocellatus* Bloch, which comes from the West Indies. This fish is characterized by a high, somewhat triangular dorsal fin, at the base of which is a prominent black spot, ringed with white. Body color is yellow, and a band of orange, edged with black and white, passes through the eye. Three wide orange bands pass through the body, and the tail base is orange, with two narrow white bars.

Size: About 6 inches at maturity.

SCIENTIFIC NAME: *Pomacanthus amularis* Bleeker.

POPULAR NAME: Circled Angelfish from Ceylon.

RANGE: Throughout the central, tropical Indo-Pacific, especially Ceylon.

DESCRIPTION: This beautiful fish is easily identified by its color pattern. The blue striping varies with age, but it is still considered one of the rare beauties of the coral reefs. The fish is referred to in some books as *Holacanthus amularis*, an incorrect name.

SCIENTIFIC NAME: *Pomacanthus arcuatus* Linnaeus.

POPULAR NAME: Black Angelfish.

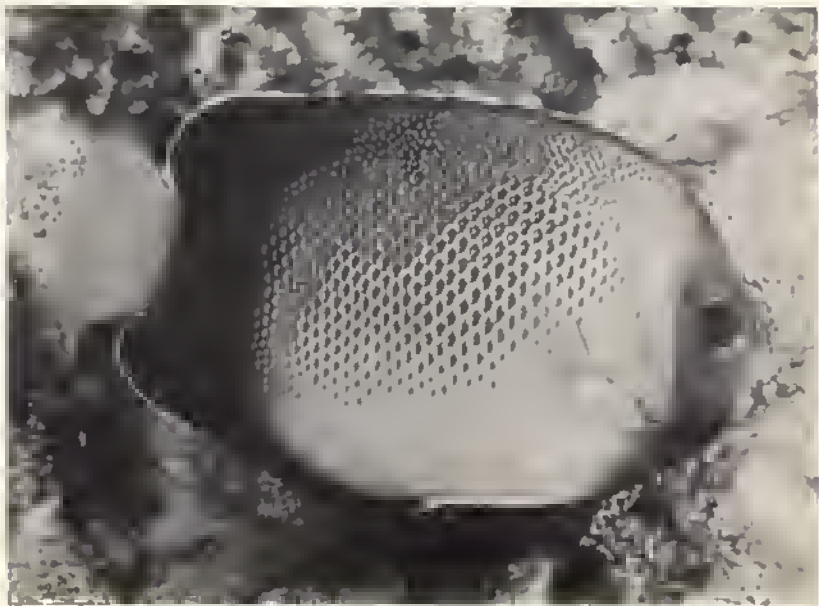
RANGE: West Indies to Brazil, common in Florida.

DESCRIPTION: As this is a large fish when mature, perhaps it would be best to describe the young specimens which we get for our



Holacanthus maculosus has an attractive spotted pattern. Photo by Wilhelm Hoppe.

Another **Holacanthus** species, for which we could find no identification. Photo by Gerhard Budich.





Choetodon ocellatus is a well-known Butterfly Fish from Florida.
Photo by Robert P. L. Straughan.



A highly-prized Butterfly Fish is *Chaetodon nicobariensis*.

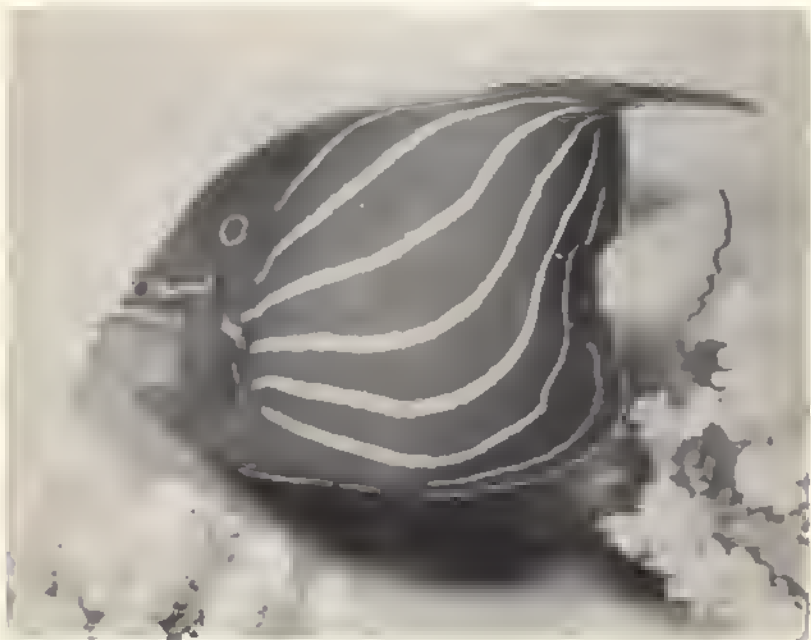
This *Choetodon octofasciatus* come from the Philippines. Photo by Earl Kennedy.





A young specimen of ***Pamacanthus annularis***. Photo by Wilhelm Hoppe.

Note how the pattern changes as the fish get older. Photo by Gerhard Budich.





Black Angelfish, *Pomacanthus arcuatus*. N.Y.Z.S. Photo.

aquaria. Until it is about 4 inches in length, this beauty is jet-black with 4 white bars down the sides. As it becomes older, these bars fade out and the black becomes silvery gray, covered with small black dots. Dorsal and anal fins elongate into filaments which extend about as far back at the edge of the tail.

SIZE: Full grown specimens attain a length of 2 feet.

SCIENTIFIC NAME: *Pomacanthus imperator* Bloch.

POPULAR NAME: Butterfly Fish.

RANGE: East Indies.

DESCRIPTION: Here is a particularly showy fish; the body color is purple, with about 20 bright yellow wavy lines extending from the head to the base of the tail, which is bright orange.

SIZE: About 8 inches when mature.



The dusky beauty of **Chaetodon polymnus** is well illustrated in this Gene Wolfsheimer photo.



Chaetodon arnatissimus. Photo by Dr. Herbert R. Axelrod.

A Young specimen of **Chaetodon (Megaprotodon) strigangulus.**
Photo by Earl Kennedy.





The brilliant markings on this young *Pomacanthus semicirculatus* will change considerably as it gets older. Photo by Wilhelm Hoppe.

Pomacanthus semicirculatus is sometimes called the Koran Butterfly Fish. The markings in the tail, plus a little imagination, are supposed to be quotations from the Koran of the Mohammedans. Photo by Gerhard Budich.





The French Angel Fish, *Pomacanthus paru*, loses its vertical markings as it gets older. Photo by Dr. Herbert R. Axelrod.

SCIENTIFIC NAME: *Pomacanthus paru* Bloch.

POPULAR NAME: French Angelfish.

RANGE: West Indies, common around the Florida Keys.

DESCRIPTION: The young of this fish are very similar to the *Pomacanthus imperator*, except that the vertical bars are yellow instead of white. Adults become black, with a yellow edge on each scale. As with the Black Angelfish, the dorsal and anal fins are also elongated into filamentous extensions.

SIZE: About 1 foot when fully grown.



A *Pomoconthus imperator* guards its chosen spot in a coral reef.
Photo by Rodney Jonkloos.

A lively spot in an Indo-Pacific coral reef, with a small school of Moorish Idols and some Surgeonfishes. Photo by Rodney Jonkloos.





Well-known to the Hawaiians is the Long-Nosed Butterfly Fish, *Forcipiger longirostris*. Photo by Gene Walfsheimer.

SCIENTIFIC NAME: *Forcipiger longirostris* Broussonnet.

POPULAR NAMES: Long-nosed Butterfly Fish, Lauwiliwili Nukunuku Oeoe, Kikakapu.

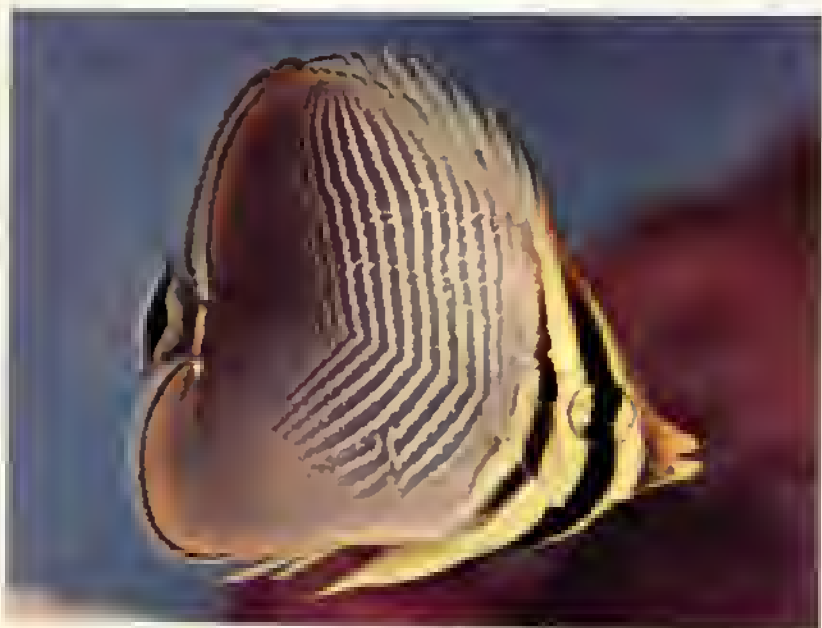
RANGE: Eastern Africa through India and the East Indies, Queensland, Melanesia, Micronesia and Polynesia as far north as the Hawaiian Islands.

DESCRIPTION: As the name indicates, this fish has a very long snout. Body color is orange above and white below, with a large triangular spot at the top of the head. This fish has been known to science since 1782. A translation of the Hawaiian name Lauwiliwili Nukunuku Oeoe is interesting: "Lauwiliwili" means "unpredictable"; "Nukunuku" means "nose," and "Oeoe" means "long," so this is an unpredictable fish with a long nose.



Choetodon striatus is found in Puerto Rico. Photo by Gene Wolfsheimer.

Choetodon (Gonochaetodon) triangulum is found, among other places, in the coral reefs of the Philippines. Photo by Earl Kennedy.

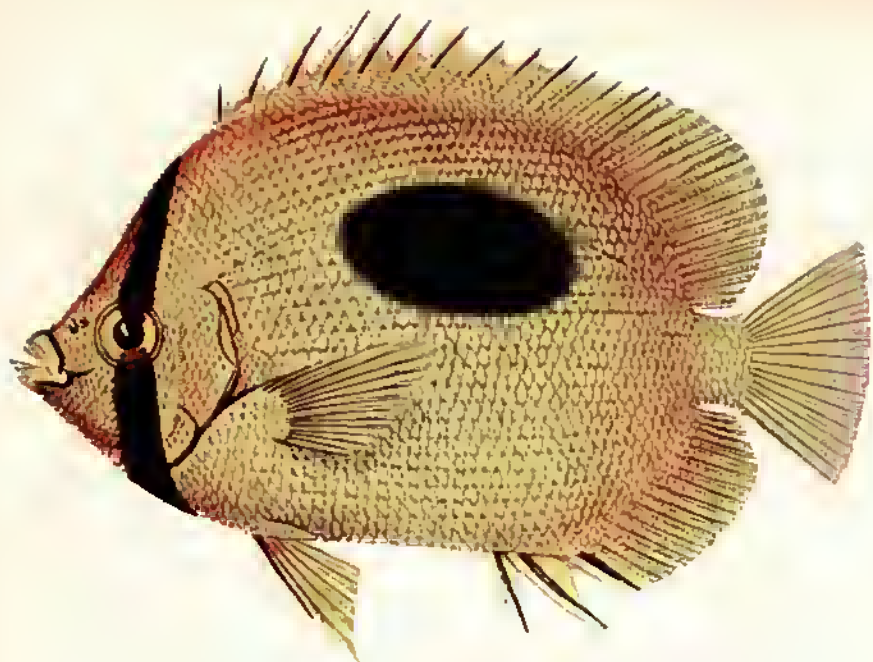




Although it is named **Chaetodon trifasciatus**, this young specimen has far more than three stripes. It loses stripes as it gets older. Photo by Earl Kennedy.

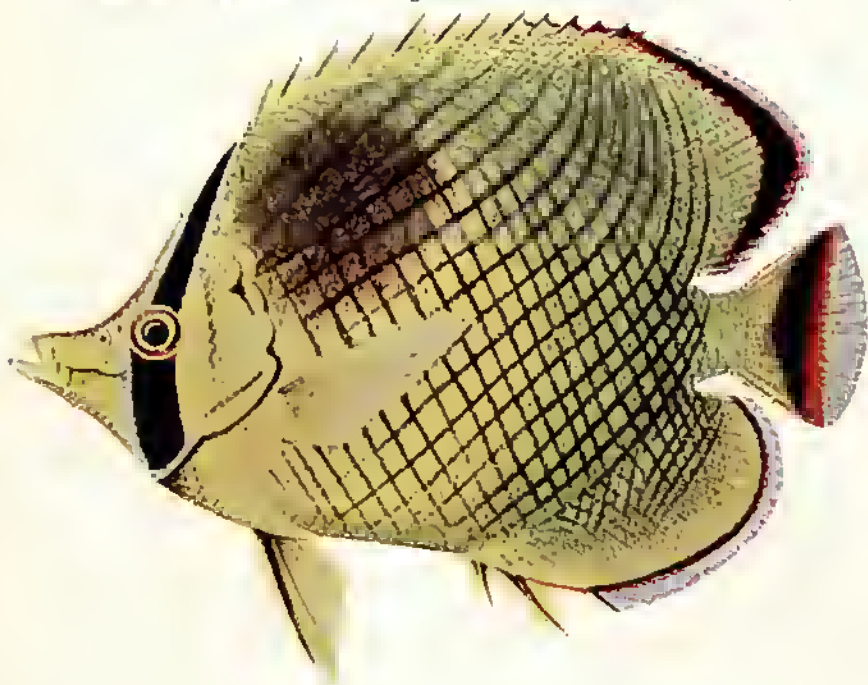
This **Chaetodon (Anisochaetodon) unimaculatus** is scarcely more than a baby. Photo by Earl Kennedy.





The large oval dark spot identifies *Chaetodon speculum*.

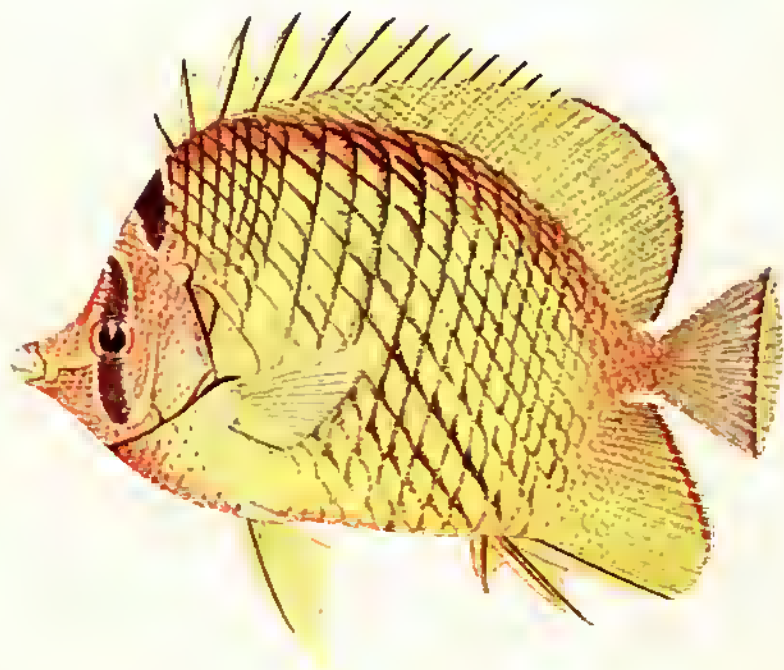
Chaetodon rafflesi has a long snout and criss-crossed markings.





As indicated by its name, **Chaetodon vagabundus** has a wide range.
Photo by Dr. Herbert R. Axelrod.

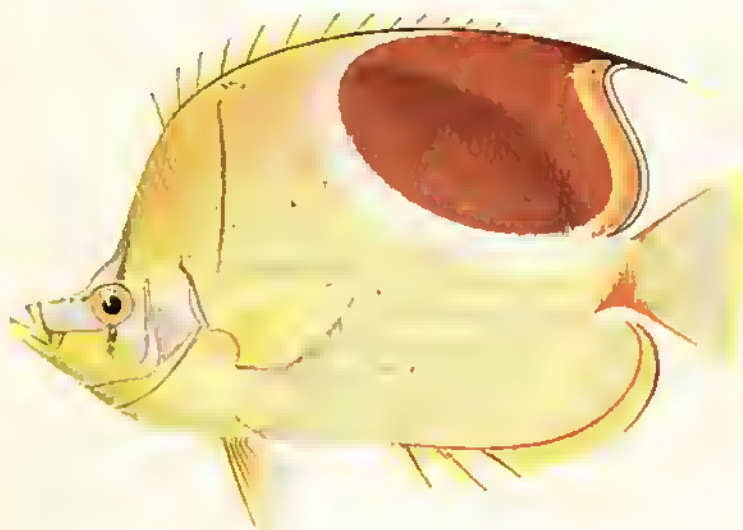
The large scales of **Chaetodon xanthurus** makes a striking pattern.





A *Chaetodontoplus* species. Being still immature, it could not be identified positively. Photo by Earl Kennedy.

Chaetodon ephippium is easily identified by the large reddish marking in the rear dorsal area.





Another **Chaetodontoplus** species which has not yet been definitely identified. Photo by Dr. Herbert R. Axelrod.

A **Chaetodon** species from the Philippines. Earl Kennedy Photo.



The Demoiselles or Damsel Fishes

Family *Pomacentridae*

This family of fishes is very popular among marine aquarists. The fish are showy, mostly small, and very hardy. Usually found in shallow water among coral reefs, this group is native to the tropical Pacific waters as well as the Atlantic.

SCIENTIFIC NAME: *Abudefduf abdominalis* Quoy and Gaimard.

POPULAR NAME: Maomao.

RANGE: Southern Polynesia to the Hawaiian Islands.

DESCRIPTION: This Damsel Fish carries a green color, and the vertical bars, usually 4 in number, are bluish black.

SIZE: Attains a length of 9 inches.

SCIENTIFIC NAME: *Abudefduf aureus* K.V.H.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: Deep golden above, yellow below. Fins are yellow, and the last soft dorsal rays, as well as the last anal rays are light blue. The middle rays of the tail are also blue. Scales are rather large, and each one has a white vertical streak running through it.

SCIENTIFIC NAME: *Abudefduf batjanensis* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The top of the head and back are red, shading to yellow on the sides. The red portion of the body is covered with blue dots.

SIZE: 3 inches.

SCIENTIFIC NAME: *Abudefduf biocellatus* Quoy and Gaimard.

POPULAR NAME: Damsel Fish.

RANGE: East Africa through India, the Andaman Islands, Nicobar, the East Indies, Melanesia, Micronesia and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: Uniform in color, except for two round spots, one at the base of the spiny dorsal fin, and the other at the base of the soft dorsal rays.

SIZE: 2 inches.

SCIENTIFIC NAME: *Abudefduf celestinus* Cuvier and Valenciennes.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The back is orange, shading to green on the sides and silver on the belly. Five vertical bars of dark brown adorn the sides, and the edge of the spiny dorsal fin is purple.

SIZE: About 6 inches at maturity.

SCIENTIFIC NAME: *Abudefduf dicki* Lien.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The entire body is golden, covered with red dots. A single dark bar crosses the after part of the body, from the soft dorsal down to the anal fin.

SCIENTIFIC NAME: *Abudefduf imparipennis* Vaillant and Sauvage.

POPULAR NAME: Damsel Fish.

RANGE: Polynesia to the Hawaiian Islands.

DESCRIPTION: The back is green, shading to gray on the sides and white below.

SIZE: 3 inches.

Abudefduf abdominalis. Photo by Dr. Herbert R. Axelrod.



SCIENTIFIC NAME: *Abudefduf leucopomus* Cuvier.

POPULAR NAME: Damsel Fish.

RANGE: Southern Polynesia, Wake Island and the Hawaiian Islands.

DESCRIPTION: This little fish has a blue line running from the snout to the eye. The body color is light anteriorly, becoming purplish behind. The scales on the sides are marked with purple spots.

SIZE: 3 inches.

SCIENTIFIC NAME: *Abudefduf leucozona* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: This attractive little fish is dusky in the upper half of the body, and yellowish below. A large black ocellus ringed with blue appears at the base of the soft dorsal fin, and a bright blue bar adorns the sides from the first spiny dorsal rays to the middle of the belly.

SIZE: 3 inches.

SCIENTIFIC NAME: *Abudefduf melas* Cuvier.

POPULAR NAME: Black Demoiselle Fish.

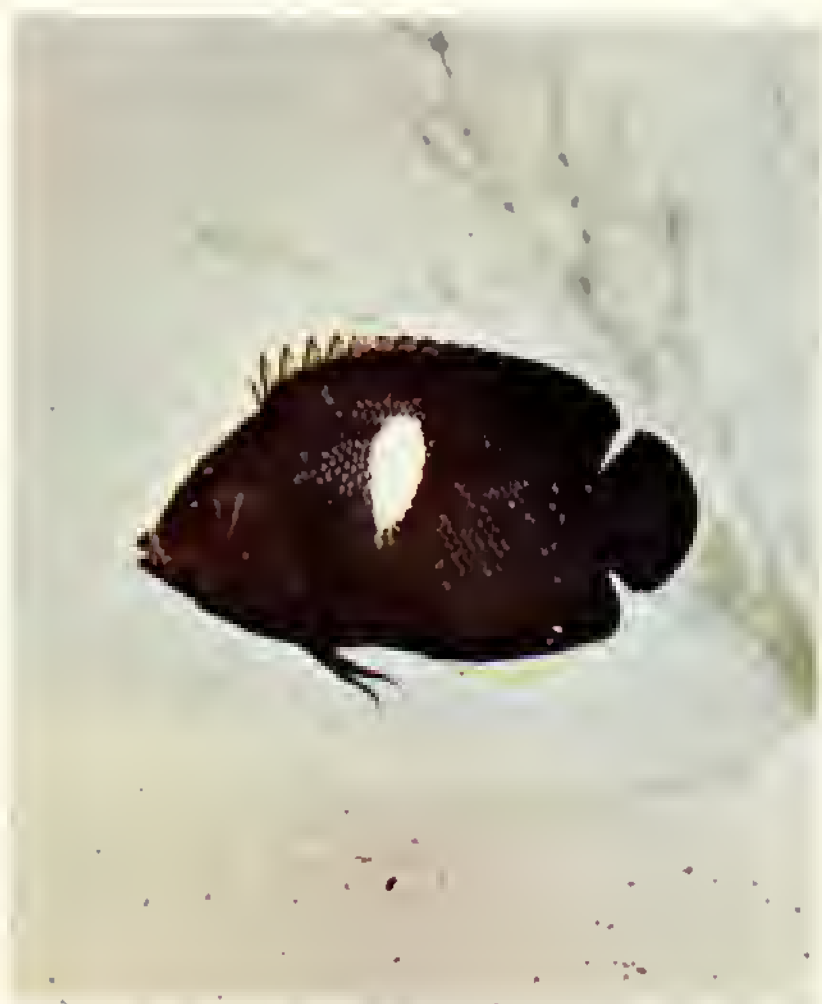
RANGE: From the Red Sea and Zanzibar through the East Indies, Melanesia and the Hawaiian Islands.

DESCRIPTION: Resembles *D. trimaculatus*, but is a larger fish and does not carry any white spots. The body is a uniform velvety black.

SIZE: 6 inches.

The blue bar and acellated spot of *Abudefduf leucozona* make the fish easily identifiable.





Abudefduf melas. Adults lose the attractive white spot on the sides and turn completely black. Photo by Earl Kennedy.

SCIENTIFIC NAME: *Abudefduf lacrymatus* Quoy and Gaimard.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: Body color olive green. Scales on the upper half of the body are sprinkled with light spots, and those on the belly have light areas.

SIZE: 4 inches.

SCIENTIFIC NAME: *Abudefduf plagiometopon* Bleeker.

POPULAR NAME: Damsel Fish.

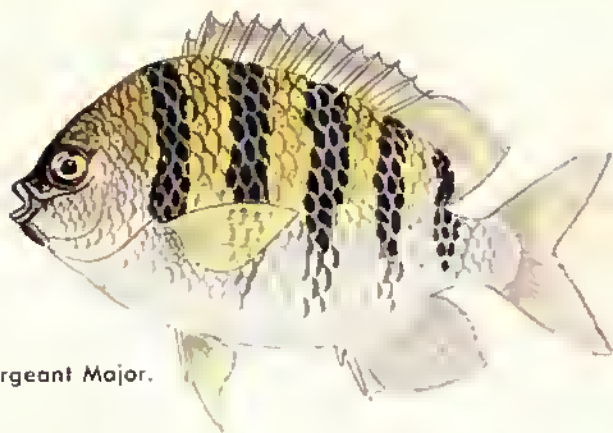
RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The entire body is olive green, and the fins are pink. The head is covered with white dots, and a vertical white streak appears on each scale.

SIZE: About 6 inches.

The Sergeant Major, *Abudefduf saxatilis*, is frequently found along the Florida coast. Photo by Dr. Herbert R. Axelrod.





The Sergeant Major.

SCIENTIFIC NAME: *Abudefduf saxatilis* Linnaeus.

POPULAR NAMES: Sergeant Major, Cockeye Pilot, Prison Fish.

RANGE: Both tropical coasts of the Americas.

DESCRIPTION: A small, heavy-bodied fish, with vertical alternating black and yellow bars. This fish is peaceful, but a hearty eater and is likely to get the lion's share of the food at aquarium meal-times.

Size: 6 inches at maturity.

SCIENTIFIC NAME: *Abudefduf septemfasciatus* Cuvier and Valenciennes.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The upper half of the body is bright green, becoming lighter on the sides to silvery on the belly, with a light rosy sheen. A very attractive fish.

SIZE: About 6 inches at maturity.

SCIENTIFIC NAME: *Abudefduf sordidus* Forskal.

POPULAR NAMES: Kupipi, Oonui Aoao Nui.

RANGE: Red Sea, Zanzibar, Mauritius, East Indies, China and Queensland, Melanesia and Polynesia to the Hawaiian Islands.

DESCRIPTION: Silvery above, white below, with 6 indistinct darker bars. There is a black spot just behind the dorsal fin.

SIZE: 8 inches.

SCIENTIFIC NAME: *Abudefduf ternatensis* Bleeker.

POPULAR NAME: Damsel Fish.



Abudefduf trifasciatus has more than the three bands indicated by its name.

Abudefduf sordidus is dusky and does not show the bars plainly.



RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: Body golden yellow, with 5 vertical bars of slightly darker color.

SIZE: 4 inches.

SCIENTIFIC NAME: *Abudefduf trifasciatus* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The body is dull orange above to light brown below, tinged with a rosy glow in the after part. There are six dusky green vertical bars.

SIZE: About 4 inches.

SCIENTIFIC NAME: *Abudefduf uniocellatus* Quoy and Gaimard.

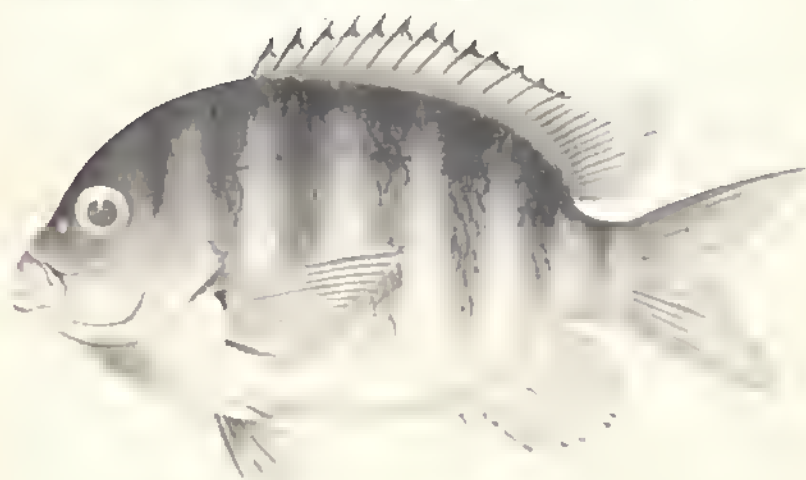
POPULAR NAME: Damsel Fish.


RANGE: Ceylon, the East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: Body color blue, all fins edged yellow. A round black spot appears at the base of the soft dorsal fin, and all the scales have bright red dots.

SIZE: 3 inches.

Abudefduf septemfasciatus has the seven bars that its name indicates.





Dascyllus reticulatus, from the Red Sea. Photo by Dr. Herbert R. Axelrod.





Chromis marginatus, the Reef Fish, is found in the West Indies and off the Florida coast.

SCIENTIFIC NAME: *Chromis marginatus* Castelnau.

POPULAR NAME: Reef Fish.

RANGE: West Indies to the Florida Keys.

DESCRIPTION: Deep iridescent blue, with a black-edged deeply forked tail. These do well in the marine aquarium if fed live foods and given plenty of aeration. Their disposition is peaceful.

SIZE: Mature specimens attain a length of 6 inches.

SCIENTIFIC NAME: *Dascyllus arcuatus* Cant.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: This is almost a duplicate of *D. melanurus*. Body color is also white, but the first vertical bar extends diagonally from the spiny dorsal rays through the eye to the mouth. The second and third bars cover about the same area as *D. melanurus*, but are edged with red, and the tail is colorless. The ventral fins are also very dark in this species.

SCIENTIFIC NAME: *Dascyllus aruanus* Linnaeus.

POPULAR NAME: Damsel Fish.

RANGE: From the Red Sea, East Africa, through India, the East Indies, along China and Queensland, through Melanesia, Micronesia and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: Short-bodied, silvery with black bars.

SIZE: About 3 inches.



This color phase of **Dascyllus aruanus** occurs when the fish is young.
Photo by Gene Wolfsheimer.

Note the distinct colors in the dorsal fin in this phase of **Dascyllus aruanus**. Photo by Earl Kennedy.





A mature specimen of *Dascyllus aruanus*. Photo by Dr. Herbert R. Axelrod.

SCIENTIFIC NAME: *Dascyllus marginatus* Ruppell.

POPULAR NAME: Striped Damsel Fish.

RANGE: The same wide distribution as *D. aruanus*.

DESCRIPTION: A silvery fish with black bars, very similar to *D. aruanus*, with the exception that it attains a larger size.

SIZE: 6 inches.

SCIENTIFIC NAME: *Dascyllus melanurus* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The short, stocky body is white, with three prominent chocolate brown bars. The first passes from the forehead through the eye to the throat. The second begins at the tip of the first spiny dorsal rays and extends through the pectoral fin to the belly, while the third goes from the tip of the soft dorsal rays all the way through the anal fin. The after-half of the tail is also chocolate brown, and the ventral fins are almost black.

SIZE: About 3 inches.



Dascyllus melanurus is on the left, *Dascyllus aruanus* on the right. Young specimens of *Dascyllus melanurus* are entirely black. Photo by Gene Wolfsheimer

Dascyllus melanurus. Photo by Dr. Herbert R. Axelrod.



SCIENTIFIC NAME: *Dascyllus reticulatus* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The body is white, and the rather large scales have dark edges, giving the sides a reticulated pattern. The spiny part of the dorsal fin is a dusky brown, and the ventral fins are of this same shade.

SIZE: 4 inches.

SCIENTIFIC NAME: *Dascyllus trimaculatus* Ruppell.

POPULAR NAMES: Three-spotted Damsel Fish, Aloiloi-paapaa.

RANGE: The same wide distribution as *D. aruanus*.

DESCRIPTION: Short, blunt-nosed. Dusky in color, with a conspicuous white spot on the shoulder and another on the forehead. Small specimens do very well in the aquarium.

SIZE: About 3 inches.

SCIENTIFIC NAME: *Pomacentrus amboiensis* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The body is a golden yellow, fading to silvery toward the belly. There is a conspicuous blue spot at the top of the operculum. The fins are lemon yellow, and the anal fin has two faint blue lines running horizontally through it.

SIZE: 4 inches.

SCIENTIFIC NAME: *Pomacentrus anabatoides* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The top of the head and back are blue, and the rest of the body and fins are green. The entire body is covered with large white dots. The first and last rays of the tail fin are blue.

SIZE: 5 inches.

SCIENTIFIC NAME: *Pomacentrus cyanomos* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The upper part of the head and the back are dusky blue, and the rest of the body is yellow. The scales have light streaks



The startling contrast between the white spots and velvety-black background makes *Dascyllus trimaculatus* one of the favorites among marine aquorists. Photo by Dr. Herbert R. Axelrod.

running through them, sprinkling the whole body. The dorsal fin is blue, with a white stripe running horizontally through it. The tail is light blue, with dark blue edges, and the first and last rays are elongated into filaments which trail about $\frac{1}{2}$ inch behind the fish.

SIZE: 5 inches.

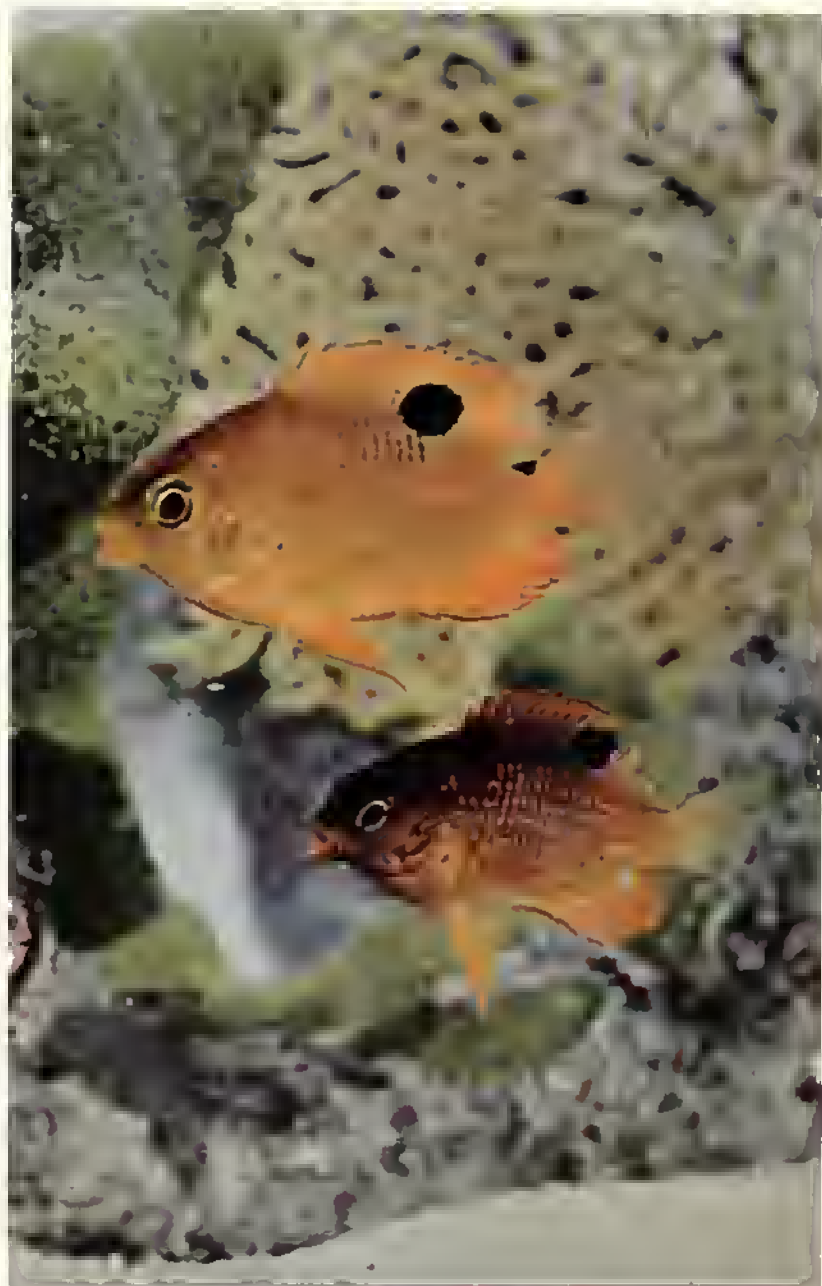
SCIENTIFIC NAME: *Pomacentrus dimidiatus* Bleeker.

POPULAR NAME: Damsel Fish.

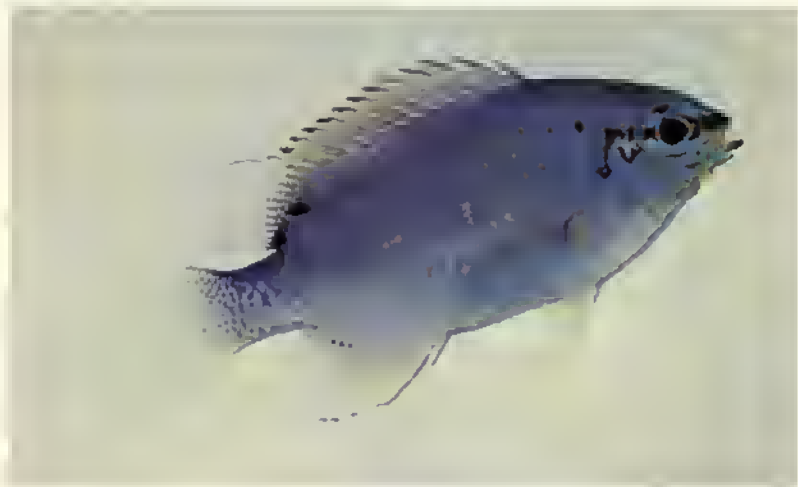
RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The upper half of the body is a dusky brown, as is the dorsal fin, which carries a blue, white-ringed ocellus at the start of the soft dorsal rays. The lower part of the body and the rest of the fins are yellow.

SIZE: 2 inches.



This picture shows how the colors of the same species can change.
Photo by Dr. Herbert R. Axelrod.



Pomacentrus coeruleus, from Israel. Photo by Dr. Herbert R. Axelrod.

soft dorsal extending onto the back. There is a smaller spot on the caudal peduncle.

SCIENTIFIC NAME: *Pomacentrus fuscus* Cuvier and Valenciennes.

POPULAR NAME: Brown Demoiselle or Maria molle.

RANGE: From the West Indies, south to Brazil and north to Key West, Florida.

DESCRIPTION: The body is uniformly dark, but the tail is mostly dusky. There is no distinct dark spot on the opercle, but the young have a distinct blue spot on the anal which fades with age. It grows to about six inches in length and is often confused with *Pomacentrus leucostictus*.

SCIENTIFIC NAME: *Pomacentrus leucostictus* Muller and Troschel.

POPULAR NAMES: Beau Gregory, Yellow Belly.

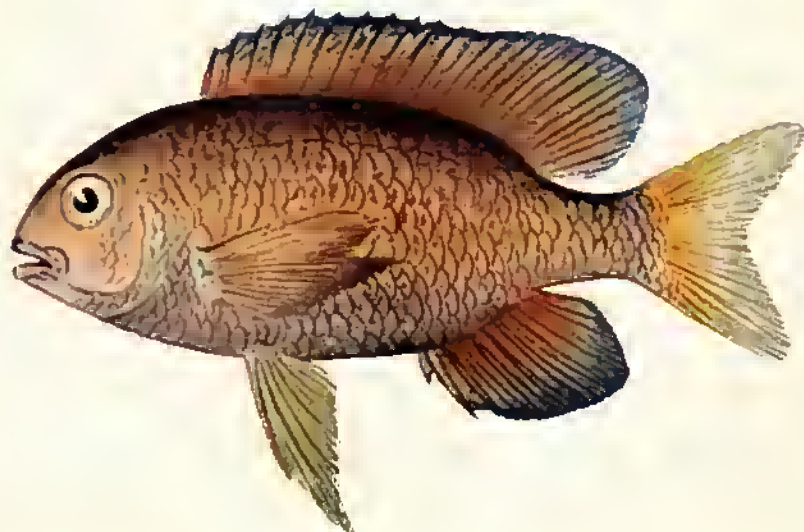
RANGE: West Indies north to Florida, where it is abundant.

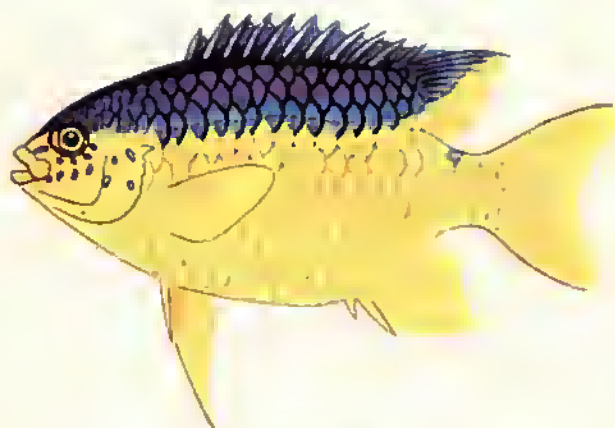
DESCRIPTION: The upper half of the body and head are deep blue, while the belly and tail are bright yellow. A dark spot appears on the dorsal fin just behind the spiny rays. Larger specimens of this species should be avoided, unless they are kept by themselves. They are very apt to be scrappy.



Pomacentrus fuscus, from the West Indies. Photo by Dr. Herbert R. Axelrod.

An older specimen of **Pomacentrus fuscus**.





The Beu Gregory, *Pomacentrus leucostictus*.

A young Beu Gregory. Photo by Dr. Herbert R. Axelrod.





Pomacentrus flaviatilis. Photo by Dr. Herbert R. Axelrod.

Another color phase of **Pomacentrus leucostictus.** Photo by Dr. Herbert R. Axelrod.





The Yellow-Tailed Domsels, *Pomacentrus melanochir*, are popular because of the contrast between the blue body and the yellow tail.
Photo by Wilhelm Hoppe.

SCIENTIFIC NAME: *Pomacentrus melanochir* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The entire body is purple, dotted all over with light spots. Dorsal, pectoral and tail fins are brown, and the anal fin purple.

SIZE: 3 inches.

SCIENTIFIC NAME: *Pomacentrus melanopterus* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: Upper part of the body is dusky reddish, shading to yellow underneath. Fins are rosy, lightly striped with blue.

SIZE: 4 inches.

SCIENTIFIC NAME: *Pomacentrus pavo* Lacepede.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: This fish has a green body, with several rows of white spots above and below. The middle part of the sides is marked by a great number of white vertical streaks.

SIZE: 5 inches.

SCIENTIFIC NAME: *Pomacentrus rhodonotus* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The upper part of the head and back of this little fish are bright orange. The rest of the body and fins are light brown, except that the pectoral fins are yellow; a large dark blue-ringed ocellus appears at the base of the soft dorsal rays.

SIZE: 2 inches.

SCIENTIFIC NAME: *Pomacentrus taeniurus* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The upper half of the body is purple, peppered with blue and white dots. The lower half is olive green. The dorsal and anal fins are purple, the dorsal with a yellow area on the posterior end. The tail is yellow, deeply forked, and edged top and bottom with purple. The pectoral fins are yellow.

SIZE: 3 inches.

SCIENTIFIC NAME: *Pomacentrus violoscent* Bleeker.

POPULAR NAME: Damsel Fish.

RANGE: East Indies, Melanesia, Micronesia and Polynesia.

DESCRIPTION: The body is stockier in build than the preceding species. The head is golden, with red-edged scales. The rest of the body is violet, and each scale has a vertical golden marking, as well as a red edge. A wide yellow bar is located at the tail base, and the fins are violet in color. The tail is green, with slightly elongated rays at the top and bottom. A bright green spot occurs at the upper end of the gill-cover.

SIZE: 4 inches.



Micraspathodon chrysurus, the Yellow-Tailed Demoiselle.

A mature pair of *Pomacentrus violascens*, which come from the Philip-
pines. Photo by Gene Wolfsheimer.





It is a pity that the blue spots on the Marine Jewelfish disappear when the fish gets older. Photo by Dr. Herbert R. Axelrod.

SCIENTIFIC NAME: *Microspathodon chrysurus* Cuvier and Valenciennes.

POPULAR NAMES: Marine Jewelfish, Yellow-tailed Demoiselle.

RANGE: West Indies to southern Florida.

DESCRIPTION: The short, stocky body is dark blue; in young specimens the body is covered with brilliant light blue spots. As the fish grows older, the spots disappear, and the tail becomes brilliant yellow.

SIZE: 6 inches at maturity.



Pomacanthus arcuatus, an adult pair. Photo by Wilhelm Hoppe.

Pomacanthus maculosus. Photo by Wilhelm Hoppe.





Pomacanthus annularis. Photo by Dr. Herbert R. Axelrod.

Here is what the Germans call the "Kaiserfisch" (Emperor Fish), as suggested by the specific name *imperator*, Photo by Dr. Herbert R. Axelrod.

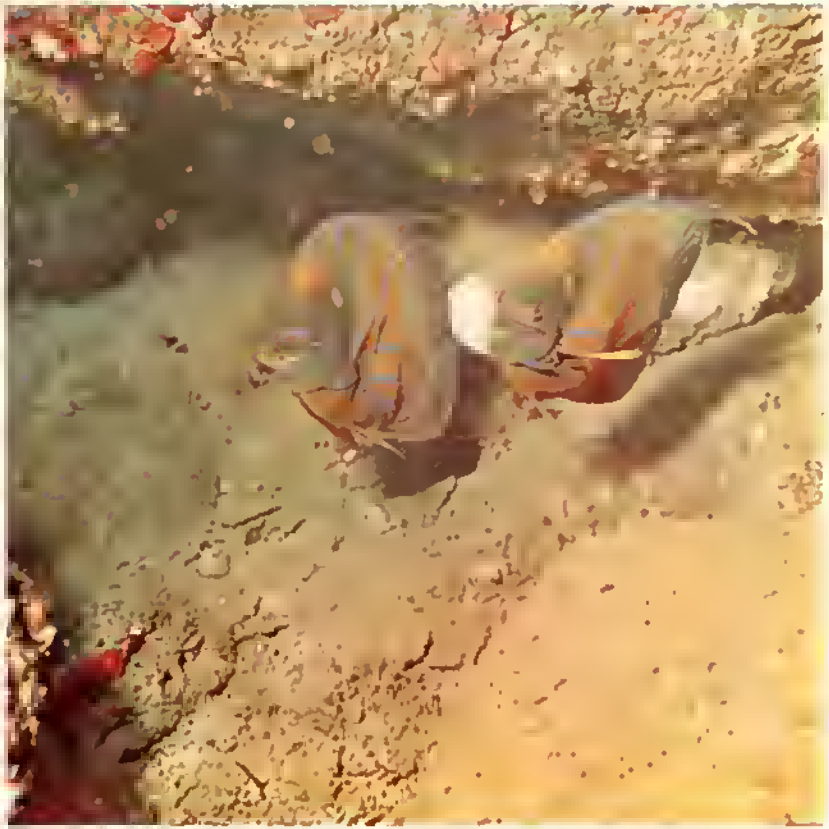




Pomacanthus semicirculatus, juvenile form Photo by Gene Walfsheimer.

Pomacanthus imperator undergoes considerable changes from the young form before it gets the adult coloration shown on the preceding page.





A pair of *Pomacanthus annularis*, guarding a coral cleft. Photo by Rodney Jonklaas.



Pomacanthus semicirculatus, adult form. Photo by Rodney Jonkloos.

The immature coloration of the Rock Beauty, *Holocanthus tricolor*.
Photo by Dr. Herbert R. Axelrod.





The yellow bars of the French Angelfish, *Pomacanthus paru*, disappear as the fish grows. Photo by Dr. Herbert R. Axelrod.

The Triggerfishes

Family *Balistidae*

The Triggerfishes, besides being a gaily colored lot, are interesting for a number of other reasons. Their exotic appearance makes them the subject of a great deal of attention. Also they have an unusual locking mechanism that makes them quite unique and attractive to the mechanically-minded. The spiny dorsal fin is located well forward of the soft dorsal fin, almost at the top of the head. When erected, this locks itself in place until the first rays of the soft dorsal fin are folded down to release it. This spike does not seem to be a weapon; the fish uses it to hold himself in place when he comes to rest at night. He jams himself into a hole in the coral and erects the spike, which holds him there firmly until he chooses to release himself.

The shape of the Triggerfish's body is also highly unusual among fishes; its form is compressed, and the head in relation to the rest of the body is immense. The mouth is small, making the head appear still larger, and the eyes are set high upon the forehead. Some of these fishes become quite large; size when fully grown is given here, as has been done throughout the book, assuming that the aquarist will avail himself of specimens small enough for the space at his disposal.

There is only one species listed for the Atlantic coast; actually there are more, but the Queen Triggerfish is the only one worthy of a place in the home aquarium. Among the tropical Pacific species, there are some real beauties.

SCIENTIFIC NAME: *Balistapus aculeatus* Linnaeus.

POPULAR NAME: This is one of the two species which bears the famous Hawaiian name: Humu-humu Nuku-nuku A-puaa. It might be interesting to translate: Humu-humu means "needle," and refers to the dorsal spike. Nuku-nuku means "snout" or "grunt," and puaa means "pig." Thus this is a fish which carries a needle, and has a snout or grunts like a pig.

RANGE: West Africa, Red Sea, Zanzibar, Mozambique, Mauritius, the Seychelles, the East Indies, along Queensland and China, Melanesia, Micronesia and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: The body is yellow above and white below. A wide



The famous Hawaiian "Humu-Humu-Nuku-Nuku-A-Puaa," known scientifically as *Balistapus aculeatus*. Photo by Dr. Herbert R. Axelrod.

green bar extends downward from the forehead to the pectoral fin. From the center of this line, a wavy brown band becoming green extends upward to the last dorsal rays. A bright red line extends upward from this line to the first soft dorsal rays. A blue line also extends back to the tail base, and a number of light lines extend vertically downward. The upper lip is green, and a fine red line extends back from the mouth to the pectoral fin. The anal fin is edged with blue.

SIZE: 10 inches.

SCIENTIFIC NAME: *Balistapus rectangulus* Schneider.

POPULAR NAME: Humu-humu Nuku-nuku A-puaa. (See translation above.)

RANGE: Red Sea, Zanzibar, Mozambique and India through the East Indies, along China and through Japan, Melanesia, Micronesia and Polynesia as far as the Hawaiian Islands.

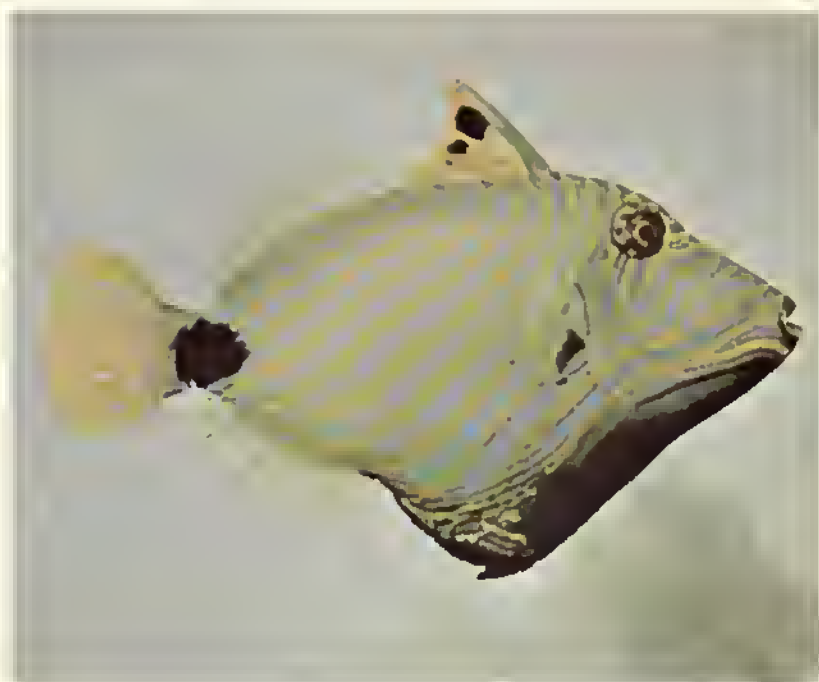
DESCRIPTION: The body is yellow above, and white below. A dark brown line comes down from the forehead to the pectoral fin, where it widens and travels diagonally downward to the anal fin base. Along half its length, this line is bordered by an orange line which extends back to the lower tail base, and also upward to the upper

tail base, leaving a wedge-shaped dark brown area at the tail base itself. There is a small but bright red line at the base of the pectoral fin.

SIZE: 9 inches.

SCIENTIFIC NAME: *Balistapus undulatus* Mungo Park.

POPULAR NAME: Orange-striped Triggerfish.



The Orange-Striped Triggerfish, *Balistapus undulatus*. Photo by Gene Wolfsheimer.

RANGE: Red Sea, Zanzibar, Mozambique, the East Indies, the Philippines, along China, through Japan, Melanesia, Micronesia and Polynesia as far as the Hawaiian Islands. Common throughout Polynesia and Japan.

DESCRIPTION: The body color is a deep mahogany brown. Several wavy orange lines curve back from the mouth, and the sides are covered with a wavy pattern of orange lines.

SIZE: 10 inches.



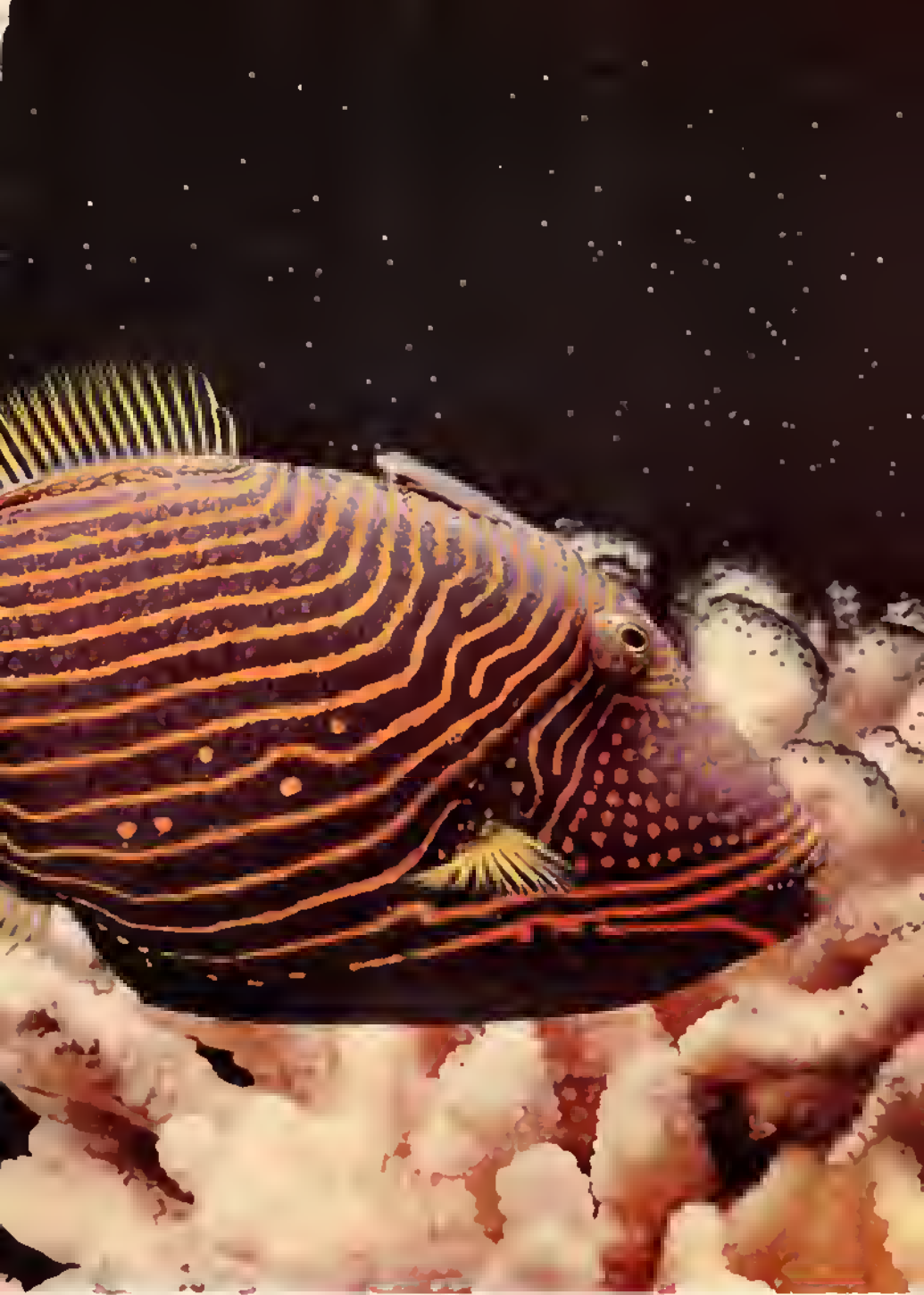
Balistes bursa is a Triggerfish from the Philippines. Photo by Dr. Herbert R. Axelrod.

Pervogor spilofoma, the Fantail Filefish, is an odd-looking but beautiful specimen. Photo by Gene Wolfsheimer.



This magnificent photo of *Balistapus undulatus* was made by Hans and Klaus Payson and shows the fantastic color pattern.





SCIENTIFIC NAME: *Balistes bursa* Schneider.

POPULAR NAMES: White-lined Triggerfish, Humu-humu Lei.

RANGE: Red Sea, East Africa, Madagascar, Reunion and Mauritius through the East Indies and Polynesia as far as the Hawaiian Islands. Abundant throughout Polynesia.

DESCRIPTION: Body color is light tan, covered with faint horizontal stripes. A crescent-shaped line curves from the spiny dorsal fin down to the pectoral, to be followed by a slightly shorter line behind it. Another line travels from the lower lip straight back to the anal opening. Below this line, the body becomes white, edged with black posteriorly.

SIZE: 8 inches.

SCIENTIFIC NAME: *Balistes capistratus* Shaw.

POPULAR NAME: Humu-humu Mimi.

RANGE: Zanzibar, Natal, Madagascar, Reunion, Mauritius, East Indies, along China and Queensland, through Melanesia and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: Uniformly light brown on the body. Around the lips, there is a rose-colored line which travels back from there to the pectoral fin.

SIZE: 12 inches.

Balistes caroliniensis is frequently caught on the Atlantic coast, especially in the warmer southern waters.





The Queen Triggerfish is common in Florida waters. Photo by Dr. Herbert R. Axelrod.

SCIENTIFIC NAME: *Balistes vetula* Linnaeus.

POPULAR NAME: Queen Triggerfish.

RANGE: Common in Florida, straying northward.

DESCRIPTION: The body is yellowish, and capable of considerable and rapid change. There are several brilliant blue lines across the face, and four short lines radiating from the eye. In adult specimens, the soft dorsal and caudal fins are extended in long filaments.

SIZE: 16 inches.

SCIENTIFIC NAME: *Balistes vidua* Richardson.

POPULAR NAMES: Pink-tailed Triggerfish, Humu-humu Hiokole, Humu-humu Uli.

RANGE: East Indies, Micronesia and Polynesia as far as the Hawaiian Islands. Abundant in Polynesia.


DESCRIPTION: Body color is solid deep brown, with a touch of red around the lips. The dorsal and anal fins are pure white, edged with black, and the tail is white on the inside half, while the outside half is pink.

SIZE: 10 inches.

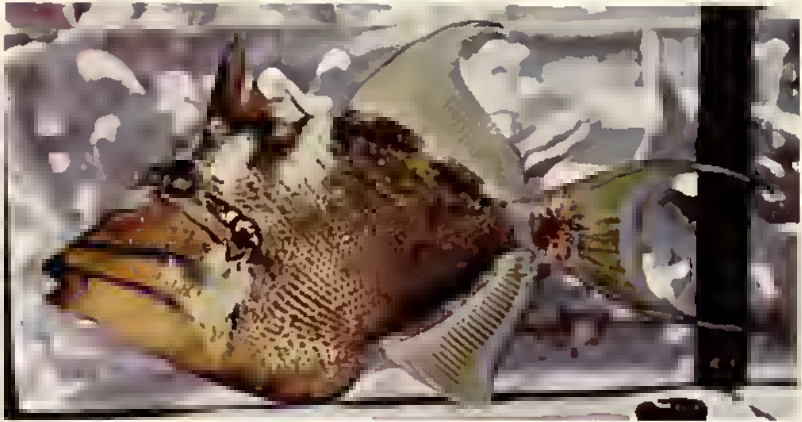


Amanses pardalis, the Mottled Triggerfish. Photo by Dr. Herbert R. Axelrad.



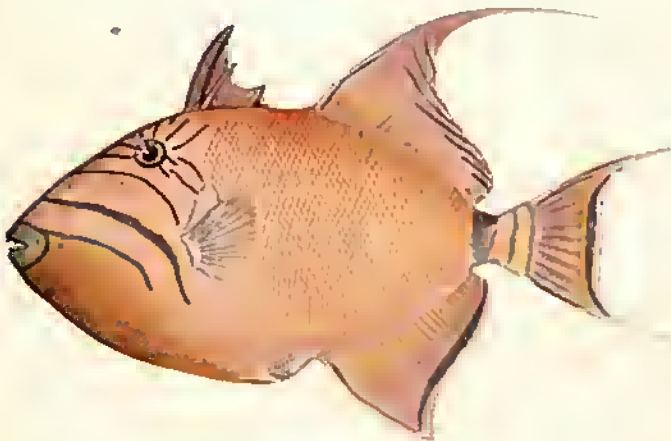


Head of *Balistes vetula*. Note the beautiful green eye. Photo by Dr. Herbert R. Axelrod.



A young specimen of the Queen Triggerfish, *Balistes vetula*. Photo by Dr. Herbert R. Axelrod.

When mature, the Queen Triggerfish looks like this.





One of Rodney Jonklaas' helpers with an expensive handful of *Balistoides conspicillum*. Photo by Rodney Jonklaas.

SCIENTIFIC NAME: *Balistoides conspicillum* Bloch.

POPULAR NAME: Clown Triggerfish.

RANGE: Throughout the tropical Indo-Pacific, even as far south as Durban, South Africa.

DESCRIPTION: If there is such a thing as "the most beautiful fish in the world" this fish is elected. It is certainly the most expensive and the most universally desired fish. When an aquarium boasts specimens of these fish they draw immense crowds. There is only one major shipper of these fish, Rodney Jonklaas, who captures them in the Maldive Islands. His price is about \$250 each, shipped from Ceylon at the purchasers' expense and risk. Half die before they reach where they are going because of the rough handling they've gotten.



Its fantastic color and markings make *Balistoides conspicillum* one of the most prized fishes in the world. Photo by Hans and Klaus Paysan.

SCIENTIFIC NAME: *Melichthys burva* Lacepede.

POPULAR NAME: Humu-humu Ele-ele.

RANGE: Zanzibar through the East Indies, along China, through Melanesia, Micronesia and Polynesia to the Hawaiian Islands.

DESCRIPTION: The body color is a dark olive-green, with fine red horizontal stripes. The base of the soft dorsal fin and the base of the anal fin are marked by a blue line.

SIZE: 12 inches.

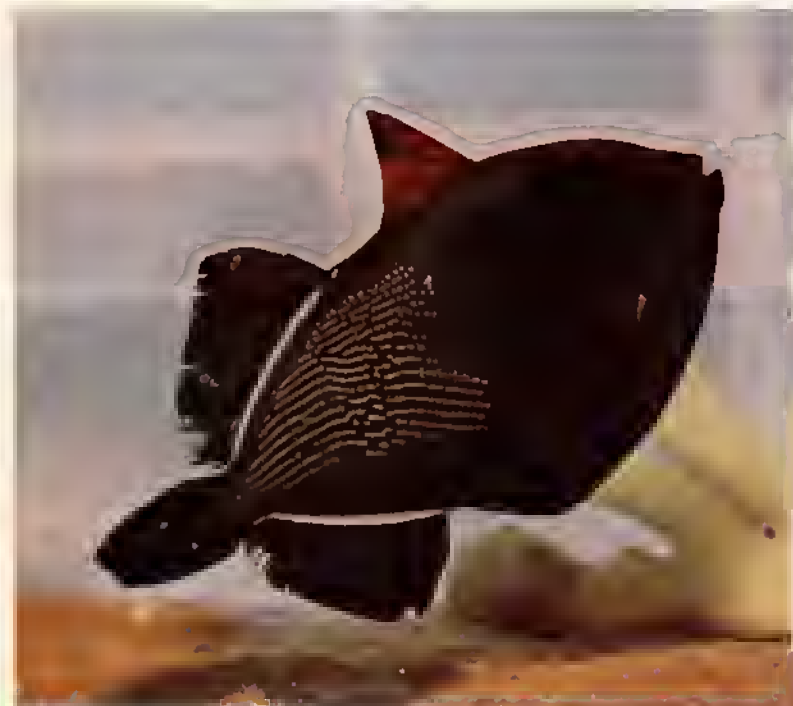
SCIENTIFIC NAME: *Melichthys ringens* Osbeck.

POPULAR NAME: Black Triggerfish.

RANGE: Every warm water ocean contains Black Triggerfish, so common are they.

DESCRIPTION: The Black Triggerfish is about 20 inches long and is a scrappy game fish when caught on very light line. Once you

Although the fins of this *Melichthys ringens* are a bit tattered, they will quickly grow back again. Photo by Dr. Herbert R. Axelrod.





Melichthys piscus is almost identical with *M. ringens*. Photo by Dr. Herbert R. Axelrod.

Odonus niger, the Green Triggerfish. Photo by Peter Irtz.



find a place to find them, they will be there by the thousands. Like most Triggerfishes, they sleep on their sides, just lying on the bottom as though they were dead.

SCIENTIFIC NAME: *Odonus niger* Ruppell.

POPULAR NAME: Redfang Triggerfish.

RANGE: Throughout the tropical Indo-Pacific.

DESCRIPTION: A fish very easy to remember since it is uniformly colored a light to dark green and the teeth are unmistakably red. It grows to about 20 inches long, but can be dwarfed by underfeeding and by keeping it in a small aquarium.

Rodney Jonklaas leaves the water with a colorful Ceylonese fish in his net.



The Wrasses

Family *Labridae*

The Wrasses are a very large group of fishes which occur in practically all tropical waters. There are even two members of this family which invade northern waters, but they are too large and have too few colors to be of interest to the aquarist. There is no lack of color in the tropical members of the family, however, and the group provides the marine aquarist with many highly colorful and interesting species.

These little fishes have the habit of nibbling constantly at bits of coral, ever on the hunt for food in the form of small crustaceans or worms. In the aquarium, they usually take food readily, and are not difficult to keep. They often assume odd positions in repose, sometimes partially burying themselves in the sand, or lying on their sides. Strangest of all is assumed by the Bluehead, *Thalassoma bifasciatum*. It not only lies on its side in a depression, but actually manufactures a bubble with which it covers itself.

SCIENTIFIC NAME: *Anampses cuvier* Quoy and Gaimard.

POPULAR NAMES: Opule, Hilu, Spotted Wrasse, White-spotted Wrasse.

RANGE: Hawaiian Islands.

DESCRIPTION: The top of the head and back are light brown, becoming sooty black on the sides. The mouth, throat and belly are white, covered with small red dots. The black sides are covered with numerous rows of pearly white spots, and the tail is orange. A very attractive fish.

SIZE: Attains 12 inches.

SCIENTIFIC NAME: *Anampses godeffroyi* Gunther.

POPULAR NAME: Opule.

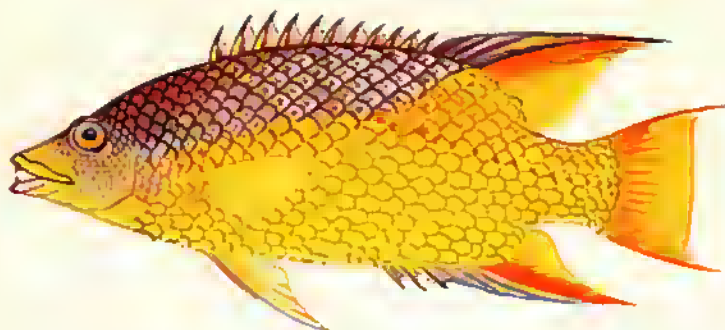
RANGE: Polynesia to the Hawaiian Islands.

DESCRIPTION: Brownish red in color, marked with about a dozen pale horizontal stripes.

SIZE: 12 inches.

SCIENTIFIC NAME: *Bodianus rufus* Linnaeus.

POPULAR NAME: Spanish Hogfish.



The Spanish Hogfish, *Bodianus rufus*, gets to be quite large, and only small specimens are suitable for home aquaria.

RANGE: Common in the West Indies, reaching north to the Florida Keys.

DESCRIPTION: Young specimens, the only ones with which the aquarist need concern himself, are blue anteriorly, changing abruptly to yellow posteriorly. Small fish have the habit of swimming in attendance to larger fishes in the aquarium, nibbling at their sides. Far from resenting this, the other fishes seem to enjoy it.

SIZE: Attains a length of 2 feet, but small specimens are usually available.

SCIENTIFIC NAME: *Cheilinus bimaculatus* Valenciennes.

POPULAR NAMES: Poou, Pilikoa Liili.

RANGE: East Indies to the Hawaiian Islands.

DESCRIPTION: This little fish is rosy red in color, and there are many orange colored lines throughout the body formed by the edges of the scales. The head has numerous orange lines radiating from the eye. According to Hawaiian legend, this was the last fish to be created.

SIZE: 5 inches.

SCIENTIFIC NAME: *Cheilinus unifasciatus* Streets.

POPULAR NAMES: Poou, Papai.

RANGE: East Indies and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: Somewhat variable in color; usually reddish brown. Each scale has a vertical line, giving the sides a characteristic pattern.

SIZE: 10 inches.

SCIENTIFIC NAME: *Cheilio inermis* Forskal.

POPULAR NAME: Kupoupou or Cigar Wrasse.

RANGE: Widely distributed throughout the Indo-Pacific region.

DESCRIPTION: The color is very variable. The Hawaiian species is green or brown and this is probably a sex difference with the male being green and the female brown. In other areas the females are yellow and the males a bright blue-green. It is interesting that some males, when in a state of bright green coloration, have green flesh and green bones. The author (HRA) caught and ate a 16 inch specimen and noticed that only one male had this interesting characteristic. There was no obvious taste difference. This is the only species in the genus.



Cheilio inermis, because of its shape, is known as the Cigar Wrasse.
Photo by Gene Wolfsheimer.

SCIENTIFIC NAME: *Coris flavovittatus* Bennett.

POPULAR NAMES: Hilu, Black-banded Wrasse.

RANGE: Hawaiian Islands and Guam.

DESCRIPTION: The body color of this fish varies from a light tan to rosy pink. Two white stripes run the length of the body from the snout to the tail, with a third shorter white stripe between. The area between these stripes is brown on the body, and red on the head. The dorsal fin has a series of yellow spots on a brown area, and the anal is deep brown. The tail is brown, edged with white. Large ones are frequently seen in Hawaiian markets.

SIZE: Attains 16 inches in length.



Coris gaimard is beautiful and easily kept. Photo by Wilhelm Hoppe.

SCIENTIFIC NAME: *Coris gaimard* Quoy and Gaimard.

POPULAR NAMES: Hinalca Akilolo, Hinalca Lolo, Lolo, Lazy Fish, Redlined Wrasse.

RANGE: Zanzibar, Ceylon, East Indies, Ryukyu, Melanesia, Micronesia and Polynesia to the Hawaiian Islands.

DESCRIPTION: The body is deep brown, with blue-edged violet spots and a golden tail. The head is somewhat lighter in color, and is marked with several irregular green streaks. The dorsal and anal fins are edged with brilliant red. This fish is fond of burying itself in the sand with only its snout protruding, for which reason it is called "Lazy Fish."

SIZE: 12 inches.

SCIENTIFIC NAME: *Coris greenovi* Bennett.

POPULAR NAME: Wrasse.

RANGE: Micronesia and Polynesia to the Hawaiian Islands.

DESCRIPTION: This fish is a standout in any aquarium. The body, dorsal and anal fins are a deep brilliant red. There are five white spots, ringed with black. The first appears on the snout, the second on the forehead; then there is a diamond-shaped spot which extends into the forepart of the dorsal fin from the back, and another smaller but similarly shaped spot which occupies the same position at the back end of the dorsal. Just behind the dorsal, at the tail base, the fifth white mark appears; this has a green area below it, bordering

on a black area at the tail base. The tail itself is yellow, with two semicircular bars through the middle. The other fins are edged black.

SIZE: 5 inches.

SCIENTIFIC NAME: *Coris multicolor* Ruppell.

POPULAR NAME: Wrasse.

RANGE: Red Sea and Natal through Melanesia and across the Pacific Ocean to the Hawaiian Islands.

DESCRIPTION: Very similar to *C. venusta*, but has several blue stripes at the ends of the dorsal and anal fins, and six dark saddles on the back.

SIZE: 6 inches.

SCIENTIFIC NAME: *Coris venusta* Vaillant and Sauvage.

POPULAR NAME: Wrasse.

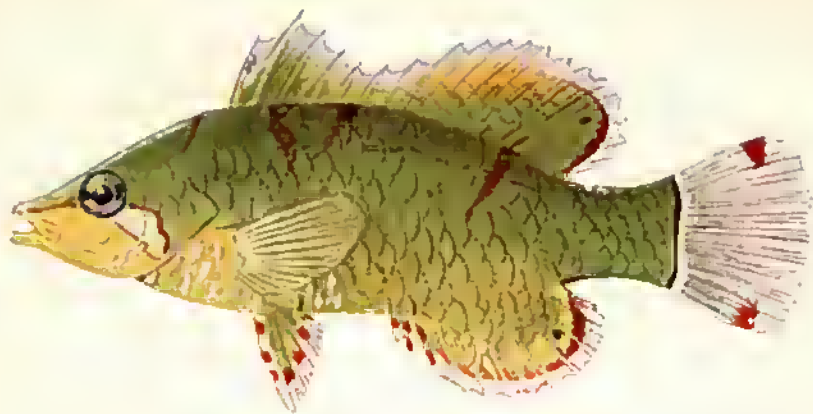
RANGE: Hawaiian Islands.

DESCRIPTION: Dark brown above, lighter below; a red stripe extends through the body, and there are many crooked bluish-green markings which appear all over the body and fins.

SIZE: 6 inches.

This little Wrasse came from Ceylon. Photo by Dr. Herbert R. Axelrod.





One of the Dwarf Wrasse, *Doratonatus decais*.

SCIENTIFIC NAME: *Doratonatus megalepis* Gunther.

POPULAR NAME: Dwarf Wrasse.

RANGE: West Indies north to the Florida Keys.

DESCRIPTION: This is the smallest of the Wrasse. Its overall color is a bright green.

SIZE: Up to 3 inches.

SCIENTIFIC NAME: *Gomphosus coeruleus* Lacepede.

POPULAR NAME: Hawaiian Bird Fish.

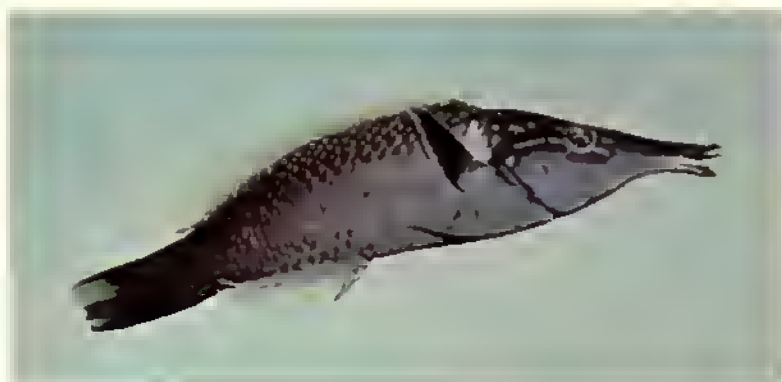
RANGE: Throughout the central Indo-Pacific as far as South Africa.

DESCRIPTION: A very fine fish for the aquarium, though extremely difficult to capture because they live in small nooks and crannies in old reefs. They are trapped occasionally. Rare specimens reach one foot in length; aquarium specimens rarely get larger than 10 inches. Males have a golden edge on their fins. Females are brownish gold all over. As the fish gets older it loses the golden edge on its scales and develops the characteristic fin edge of gold with some specimens sporting a solid golden-colored caudal fin.

SCIENTIFIC NAME: *Gomphosus tricolor* Quoy and Gaimard.

POPULAR NAMES: Bird Fish, Hinalca Iiwi, Nukulua Eleele.

RANGE: China, Japan, East Indies, Micronesia and Polynesia as far as the Hawaiian Islands.



Hawaiians call **Gomphosus varius** "Birdfish." Photo by Dr. Herbert R. Axelrod.

DESCRIPTION: The long snout which characterizes this fish is reflected in its Hawaiian name. It resembles the bill of the Iiwi bird. In color, it is deep indigo, except for blue fins and a few green areas on the body.

SIZE: 12 inches.

SCIENTIFIC NAME: *Gomphosus varius* Lacepede.

POPULAR NAME: 'Aki-lolo or Hinaloa Iiwi.

RANGE: Throughout the central Indo-Pacific, especially Hawaii.

DESCRIPTION: There are green and brown forms that have been known under different scientific names. The green form is merely the mature male while the brown form is the female of the species. They attain a length of about 10 inches. The elongated beak, which is also apparent in the genera *Pseudocheilinus* and *Wetmorella*, is the longest in the genus *Gomphosus*. The color illustration shown here is of a mature male in high breeding color.

SCIENTIFIC NAME: *Halichoeres ornatissimus* Garrett.

POPULAR NAMES: Lao, Ohua, Paawela.

RANGE: Hawaiian Islands.

DESCRIPTION: Brick red above, and pale blue below. There are six rows of pale green spots on the sides, and in some specimens there are one or two black spots on the dorsal fin, and a spot directly behind the eye. This is one of the rarer Hawaiian fishes.

SIZE: 5 inches.



Another view of *Gomphosus varius*, Photo by Gene Wolfsheimer.

SCIENTIFIC NAME: *Iniistius aneitensis* Gunther.

POPULAR NAME: Laenihi.

RANGE: Zanzibar, through Melanesia to the Hawaiian Islands.

DESCRIPTION: Body color is grayish, with indistinct vertical bars. The scales are marked with a violet spot and golden edges. The upper middle of the body just below the dorsal fin carries a black spot.

SIZE: 10 inches.

SCIENTIFIC NAME: *Iniistius niger* Steindachner.

POPULAR NAMES: Laenihi Eleele, Black Razor Fish.

RANGE: Known only as from the Hawaiian Islands.

DESCRIPTION: In shape this is almost a duplicate of the preceding fish, except that it is smaller in size, and black all over.

SIZE: 8 inches.



Hemipteronotus pentadactylus, commonly known as "Razorfish."
Photo by Dr. Herbert R. Axelrod.

SCIENTIFIC NAME: *Iniistius pavo* Valenciennes.

POPULAR NAMES: Longfin Razor Fish, Laenihi.

RANGE: Zanzibar, Mauritius, Reunion, East Indies, Micronesia and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: This fish is milky white in color, with four wide brown vertical bars crossing the body. The first three rays of the dorsal fin are separated from the others, appearing at the top of the head, dark brown in color, and somewhat elongated. This fish is distinguished by its compressed body and blunt head, with the eye high on the forehead.

SIZE: 15 inches.

SCIENTIFIC NAME: *Lepidaplois bilunulatus* Lacepede.

POPULAR NAMES: Aawa, Spot Wrasse.

RANGE: Mauritius, Ceylon, East Indies, the Philippines and Polynesia.

DESCRIPTION: The body color is a pinkish white. The soft dorsal, anal and tail fins are creamy yellow. A number of red streaks radiate from the mouth through the head, to be followed by thin horizontal

stripes through the body. A large black spot extends from behind the dorsal fin to the tail base.

SIZE: Adult specimens attain 14 inches in length.

SCIENTIFIC NAME: *Macropharyngodon godeffroyi* Quoy and Gaimard.

POPULAR NAME: Hinalea Akilolo.

RANGE: East Indies, Melanesia, Micronesia and Polynesia as far north as the Hawaiian Islands.

DESCRIPTION: Olive color. The scales have a light area which forms horizontal lines. The head is adorned with several curved bright blue lines.

SIZE: 6 inches.

SCIENTIFIC NAME: *Novaculichthys bifer* Lay and Bennett.

POPULAR NAME: Wrasse.

RANGE: Philippine Islands, throughout the East Indies, Micronesia, Melanesia, and Polynesia as far as the Hawaiian Islands.

Hemigymnus fasciatus. Photo by Dr. Herbert R. Axelrod.





A species of *Iridio*, a Wrasse from Puerto Rico. Photo by
Photo by Gene Wolfsheimer.

DESCRIPTION: This is a green fish, with four brown vertical bands on the sides. There are three white areas radiating from the eye, edged with dark green. About 10 more such green-margined white blotches appear on the sides. The dorsal fin has two elongated first spines.

SIZE: 5 inches.

SCIENTIFIC NAME: *Novaculichthys taeniourus* Lacepede.

POPULAR NAME: Wrasse.

RANGE: Zanzibar, Madagascar, Reunion, Mauritius, East Indies, the Philippines, Melanesia, Micronesia and Polynesia as far as Hawaii.

DESCRIPTION: The body is olive brown, with many light and dark mottlings on the fins. Each scale has a large white spot, giving the sides a regular pattern. Four black lines radiate from the eye.

SIZE: 10 inches.

SCIENTIFIC NAME: *Pseudocheilinus hexataenia* Bleeker.

POPULAR NAME: Alaihi Laka.

RANGE: Red Sea, Madagascar, East Indies, Polynesia to the Hawaiian Islands.

DESCRIPTION: Rosy red above, shading to yellow below. The sides are marked with about eight horizontal stripes. Often found in tide pools.

SIZE: 6 inches.

SCIENTIFIC NAME: *Stethojulis albovittata* Bonnaterre.

POPULAR NAME: Ohua.

RANGE: East Indies, Micronesia and Polynesia.

DESCRIPTION: The head and upper part of the body are green; there are two blue lines which run horizontally along the middle, and an area of bright red between. The lower half of the body is gray. The dorsal fin is bright orange, and the tail a dusky yellow.

SIZE: 5 inches.

SCIENTIFIC NAME: *Stethojulis axillaris* Quoy and Gaimard.

POPULAR NAME: Omaka.

RANGE: Red Sea, East Africa, Reunion and Madagascar through

Thalassoma ballieui has an interesting pattern. Photo by Gene Wolfsheimer.





A very young *Thalassoma bifasciatum*, known in the West Indies and Florida as "Bluehead."

the East Indies, along Queensland, through Melanesia, Micronesia and Polynesia.

DESCRIPTION: Olive colored, with several irregular white markings on the body. Easily identified by a pair of black spots at the tail base.

SIZE: 5 inches.

SCIENTIFIC NAME: *Thalassoma bifasciatum* Bloch.

POPULAR NAME: Bluehead.

RANGE: West Indies, reaching north to southern Florida.

DESCRIPTION: As the popular name indicates, the head of this species is a deep blue. Behind the head are two vertical bars of black, with a white area between. The rest of the body is bright green, and the deeply forked tail is edged with black. One of the most handsome fishes native to Florida waters.

SIZE: 6 inches.

SCIENTIFIC NAME: *Thalassoma duperrey* Quoy and Gaimard.

POPULAR NAMES: Hinalea Lauwili, Aalaihi, Hinalea Luahine, Saddle Wrasse.



When the Bluehead gets older, the after end of his body gets yellowish. Photo by Wilhelm Hoppe.

RANGE: Hawaii and some of the neighboring islands. This is the most abundant of the Wrasses in the Hawaiian Islands.

DESCRIPTION: The body of this fish is a dark green, and many purplish narrow bars cross it. There is a broad orange saddle which extends from behind the opercle to the first dorsal rays, crosses the body and widens out to cover the entire belly.

SIZE: 10 inches.

SCIENTIFIC NAME: *Thalassoma lutescens* Lay and Bennett.

POPULAR NAMES: Aalaihī, Alaihi, Orange-lined Wrasse.

RANGE: Japan, Ryukyu, northeastern Australia, Melanesia, Micronesia and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: Bluish above to pink below, the body has many fine irregular orange vertical markings. The head is decorated with wavy orange streaks.

SIZE: 6 inches.

SCIENTIFIC NAME: *Thalassoma melanochir* Bleeker.

POPULAR NAME: Wrasse.

RANGE: East Indies, Micronesia, Polynesia to the Hawaiian Islands.



Thalassoma melanochir is the fish with the white belly and yellow back in the picture. The others are Neon Gobies, *Elacatinus oceanops*.
 Photo by Robert P. L. Stroughan.

DESCRIPTION: This species has a stripe from the snout to the opercle, also a blotch at the base of the pectoral fin. Each scale has a light vertical streak.

SIZE: 6 inches.

SCIENTIFIC NAME: *Thalassoma quinquevittatus* Lay and Bennett.

POPULAR NAME: Wrasse.

RANGE: From the Cape of Good Hope through the East Indies, the Philippines, Ryukyu, Melanesia, Micronesia and Polynesia to the Hawaiian Islands.



These handsome Wrasses are *Thalassoma lucasanum*. Photo by Gene Wolfsheimer.

DESCRIPTION: This fish is also greenish in color. It has a varied mottled pattern of stripes and spots, and has several reddish stripes.

SIZE: 4 inches.

SCIENTIFIC NAME: *Thalassoma trilobata* Lacepede.

POPULAR NAME: Awela.

RANGE: Zanzibar, Madagascar, Seychelles, Reunion, Mauritius, East Indies, Melanesia, Micronesia and Polynesia to the Hawaiian Islands.

DESCRIPTION: Bright red above, shading to yellow below. The sides are marked with two horizontal rows of green rectangular spots.

SIZE: 12 inches.

SCIENTIFIC NAME: *Verriculus sanguineus* Jordan and Evermann.

POPULAR NAME: Wrasse.

RANGE: Found only in the Hawaiian Islands.

DESCRIPTION: The body color is deep red. A golden stripe extends from the lips to the tail fin, which is bright yellow.

SIZE: 8 inches at maturity.



This *Thalassoma lunare* was a bit shy about posing for his picture and had to be pushed toward the front glass.
Photo by Dr. Herbert R. Axelrod.

Thalassoma vitidum. Photo by Dr. Herbert R. Axelrod.



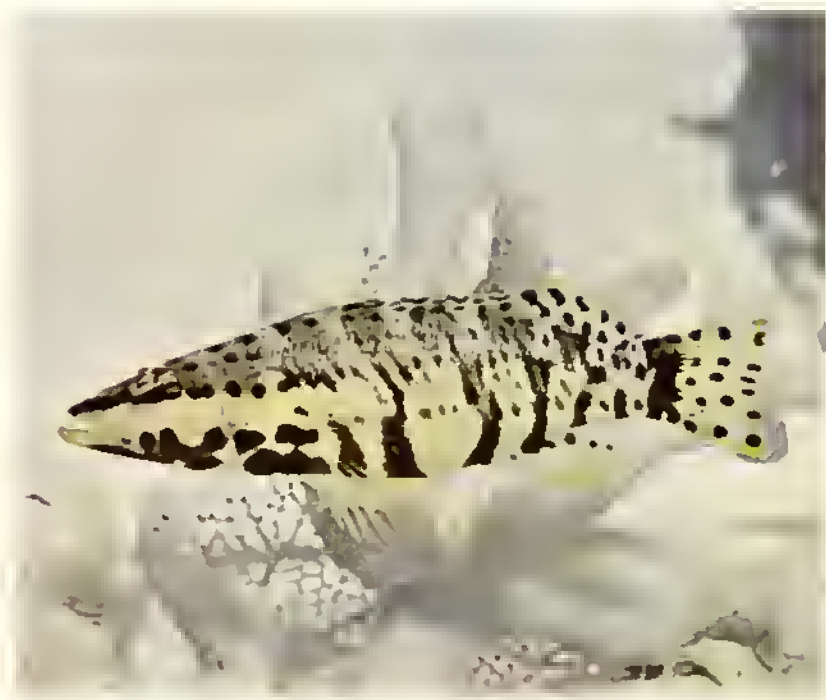


This close-up view of *Thalassoma viridum* shows the teeth, which are perfectly adapted to nibbling and tearing at the coral growths. Photo by Dr. Herbert R. Axelrod.



Prionodes baldwini, one of the Soapfishes.

Another *Prionodes* species. The Soapfishes are so named because when alarmed or taken out of the water, they are capable of throwing off a foamy slime from their bodies. Photo by Dr. Herbert R. Axelrod.





Native Ceylonese fishermen with a catch of Green Parrotfish. Photo
Photo by Rodney Jonkloos.

The Parrot Fishes

Family *Callyodontidae*

This is an unusually colorful family of fishes, some of which grow to over four feet in length and are famous game fish. But for the marine fish aquarist, the smaller specimens are the most interesting. They are elongated fish and have a "buck-teeth" look due to the coalescent teeth which form a beak to enable the Parrot Fish to munch rather unconcernedly on clams, coral, mussels, crabs and other crustaceans. They should be handled with care as they can bite and take a neat chunk of flesh away without too much difficulty. There is more than one genus of fishes in the family *Callyodontidae*, but the family is easily broken into two groups: The genus *Callyodon* contains those Parrot Fishes which have their teeth fully united to form an unbroken, smooth beak. The genera *Leptoscarus* and *Cryptotomus* have teeth which are not fully united. The genus *Leptoscarus* is easily differentiated from *Cryptotomus* because of their body depth, but this is only of importance to taxonomists.



Scaris vetula.



Pseudoscaris species, the Rainbow Parrotfish. Photo by Robert P. L. Stroughon.

Sporisoma abilgaardi.



The Sharp-Nosed Puffers

Family *Canthigasteridae*

Here we come to the Puffers or Swellfishes. This amusing family is native to the tropics of both the Atlantic and Pacific, one species being from the West Indies, and several from Pacific waters. They are found grubbing around on sandy bottoms, rather than around coral or rock bottoms. Although they resemble the Trunkfishes somewhat in body form, they differ greatly in that they do not have the outer sheath that the Trunkfishes carry. Their skin is rough and prickly, without scales, and they are able to inflate their belly with air or water until it resembles a balloon. This act is usually performed only when they are alarmed, and as a means of defense. However, they are seldom bothered by larger fishes, who probably object to the rough prickly spines.

In the aquarium, it has been found that their oxygen requirements are rather high, so it would be advisable to give them enough "elbow room." As their principal food consists of crustacea and mollusks, feed them chopped shrimp or crab meat, clams or oysters.

A Sharp-Nosed Puffer, *Canthigaster valentini*.



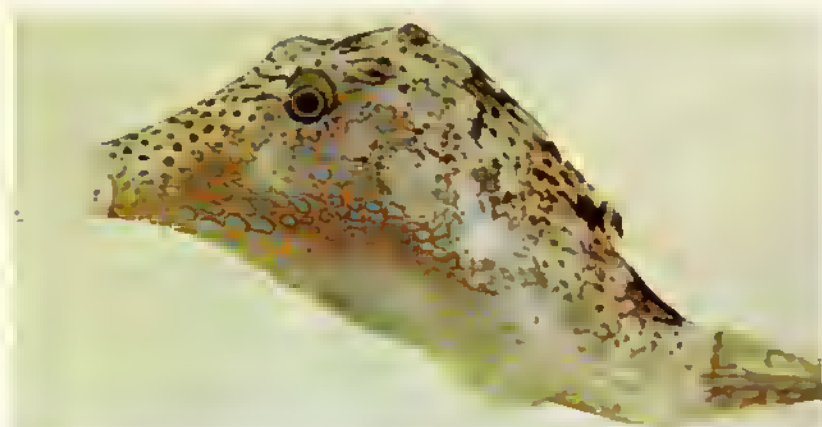
SCIENTIFIC NAME: *Canthigaster amboiensis* Bleeker.

POPULAR NAME: Sharp-nosed Puffer.

RANGE: East Indies and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: Dark above, lighter below, the upper half of the body covered with spots. Ten black lines radiate from the eye, and seven or eight horizontal lines mark the tail fin.

SIZE: 4 inches.



Canthigaster cinctus, from Israel. We thought when this fish came in that it was very sick, but later found that the tail is usually folded like this. Photo by Dr. Herbert R. Axelrod.

SCIENTIFIC NAME: *Canthigaster cinctus* Richardson.

POPULAR NAME: Puffer.

RANGE: Zanzibar through the East Indies, Queensland, Melanesia and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: Dark in color above, and white below. This fish has a slightly longer nose than the other members of the family, as well as brighter colors.

SIZE: 4 inches.

SCIENTIFIC NAME: *Canthigaster jactator* Jenkins.

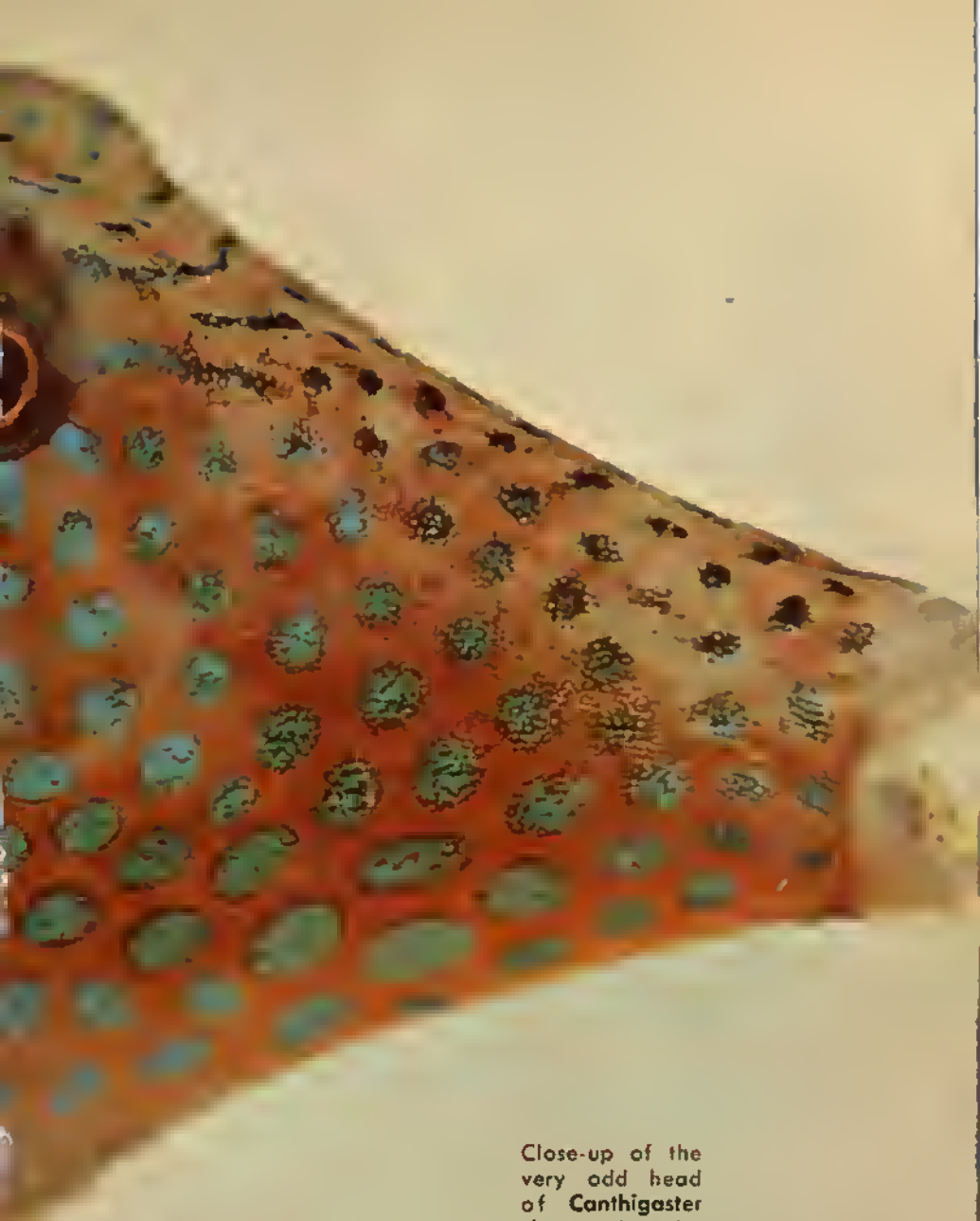
POPULAR NAME: Sharp-nosed Puffer.

RANGE: Hawaiian Islands.

DESCRIPTION: The entire body is covered with irregular blue spots, set closely together on a dark background.

SIZE: 3½ inches.





Close-up of the
very odd head
of *Canthigaster*
cinctus. Photo by
Dr. Herbert R.
Axelrod.

SCIENTIFIC NAME: *Canthigaster rivulatus* Schlegel.

POPULAR NAME: Sharp-nosed Puffer.

RANGE: Common in Japanese waters, also found in the Hawaiian Islands.

DESCRIPTION: Dark above, becoming lighter on the sides and white on the belly. A large number of small dots cover the body, and dark lines radiate from the eye and occur on the lower part of the mouth.

SIZE: 3 inches.

SCIENTIFIC NAME: *Canthigaster rostratus* Bloch.

POPULAR NAME: Sharp-nosed Swellfish.

RANGE: West Indies, rarely to Florida.

DESCRIPTION: Body color is green; there are 5 or 6 wavy lines radiating from the eye, and several faint bars across the nose. Young specimens are brown above and white below.

SIZE: 5 inches.

Canthigaster rostratus is native to the West Indies, but sometimes reaches Florida waters. Photo by Dr. Herbert R. Axelrad.





Canthigaster jactator comes from Hawaiian waters. Photo by
Gene Wallsheimer.

The Blowfishes

Family *Tetraodontidae*

The difference between these and the preceding species is that the Puffers have a distinct keel on the back, which is lacking in this family. They share the ability to blow themselves up into a ball when frightened. When taken from the water, they inflate themselves with air, and even a considerable amount of pressure will not induce them to deflate. As soon as they are replaced in the water, however, and they regain their courage, they let out a little sigh (releasing the air) and then swim away.

SCIENTIFIC NAME: *Spheroides hypselogenion* Bleeker.

POPULAR NAME: Swellfish.

RANGE: Red Sea and Zanzibar through the East Indies, Melanesia, Micronesia, and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: This species has a horizontal stripe, and many spots scattered over the head and back. There are widely scattered spines.

SIZE: 5 inches.

SCIENTIFIC NAME: *Spheroides lagocephalus* Linnaeus.

POPULAR NAME: Puffer.

RANGE: Very widely distributed; South Africa, Mauritius, along India, through Melanesia, Micronesia and Polynesia as far as the Hawaiian Islands; also found in the Atlantic, in the West Indies.

DESCRIPTION: Black above, steel-blue on the sides and a white belly spotted with black.

SIZE: 5 inches.

SCIENTIFIC NAME: *Spheroides spengleri* Bloch.

POPULAR NAME: Southern Swellfish.

RANGE: Common in Florida, straggling northwards.

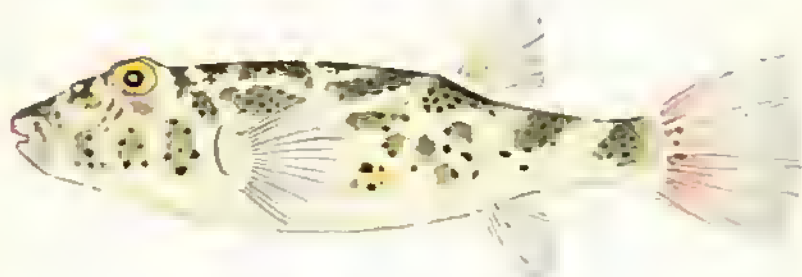
DESCRIPTION: The body is mottled, with a series of 10 spots along the ventral region to the tail base. The tail has two vertical bars, one at the base and the other at the edge.

SIZE: 8 inches.

SCIENTIFIC NAME: *Tetraodon hispidus* Linnaeus.

POPULAR NAMES: Oopuhue, Maki-maki, Keke, Akeke.

RANGE: Red Sea, Zanzibar, Mozambique, Natal, along the coast of India, Ceylon, the East Indies, Melanesia, Micronesia and Polynesia as far as the Hawaiian Islands.

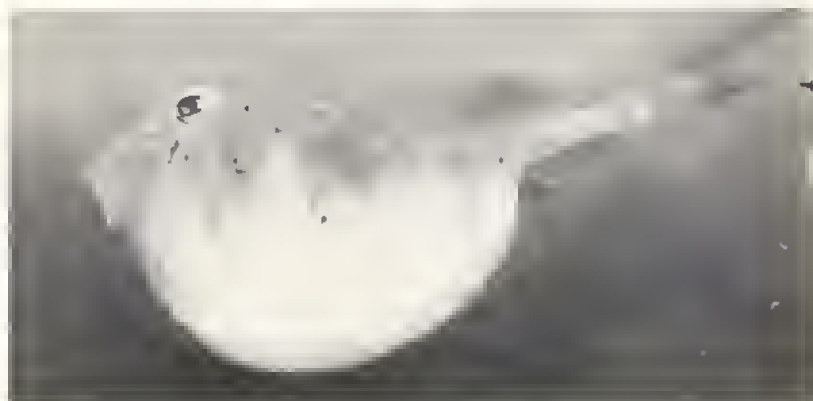


Spheroides testudineus, in its normal state.

DESCRIPTION: This fish is found not only in salt water, but also in brackish and even fresh water. The old Hawaiians regard it as highly poisonous, and it is said that the gall was once used to poison arrows. On the other hand, the Chinese regard it as a delicacy, using it as the base for a kind of soup. To paraphrase a proverb, "one man's soup is another man's poison." It is a handsome fish, olive green above and marked with blue spots. The belly is white, marked with yellow horizontal stripes.

SIZE: 14 inches when fully grown.

Harper's Swellfish, *Spheroides harperi*. N.Y.Z.S. Photo.



The Clown Fish

Family *Pomacentridae*

The Clown Fish is perhaps the best known of the marine aquarium fishes. Its startling colors make it a beautiful sight to behold, and this fish also has the added trait of being small and hardy, as well as easy to feed. Although the Clown Fish have spawned on occasion in the aquarium, there is no record of their eggs ever having been raised to maturity. Perhaps there is something missing in the water which we will some day provide, maybe by accident, and these beautiful fishes will be raised by breeders. Until then, we must content ourselves with imported specimens from the East Indies and Africa. The price is rather high, but they usually prove to be irresistible once you see them.

Amphiprion ephippium is shown here among the tentacles of a giant Florida anemone, *Stoicactis kenti*. Photo by Robert P. L. Strougon.





It was originally believed that Clownfish would get along only with the East Indian anemones, but they also accept the Florida species and live in close harmony with them. Photo by Robert P. L. Straughan.

There are many beautiful and interesting members of the Clown Fish group. As a matter of fact, there aren't any *Amphiprion* species which are not colorful and interesting. One legend must be exploded, though, and that is the old belief that only one species of Clown Fish would live in its particular species of Sea Anemone. There are many records of Sea Anemones from the Florida coast acting as host to several species of *Amphiprion* from Ceylon and the Maldiv Islands. It seems that if their own species of Sea Anemone is not available, the Clown Fish will live among the tentacles of any Sea Anemone available. It is also a fact that they are not affected by the poisonous tentacles of any species of Sea Anemone, regardless of its origin.

The varied and excellent photographs will help you to identify the various Clown Fishes presented here; there are some species which are too rare to be mentioned. It is nearly impossible to identify juvenile specimens with any degree of accuracy. The fully matured adult forms must be used for identification purposes.

Lee Chin Eng of Djakarta, Indonesia, has been the first person to repeatedly spawn the Clown Fishes of his area. He uses his "Natural System" aquarium which is "purified" by living Corals and Anemones. Up to this writing he has never raised fry past the $\frac{1}{2}$ inch mark which means that there is the possibility that additional essentials are still missing from the artificial sea aquarium.



Amphiprion sebae. Photo by Dr. Herbert R. Axelrod.

Amphiprion xanthurus. Photo by Dr. Herbert R. Axelrod.





The Two-Banded Clownfish, *Amphiprion bicinctus*. Photo by Gene Wolfsheimer.

SCIENTIFIC NAME: *Amphiprion bicinctus* Ruppell.

POPULAR NAME: Saddle Clown Fish.

RANGE: Throughout the tropical Indo-Pacific.

DESCRIPTION: This is a form which causes great confusion because of the great color differences between the adult and the juvenile forms. It is a very interesting fish and makes a fine member of the Clown community.

SCIENTIFIC NAME: *Amphiprion percula* Bleeker.

POPULAR NAME: Marine Clown Fish.

RANGE: Indian Ocean.

DESCRIPTION: The body color is orange. There is a wide white collar which encircles the after part of the head, just behind the eye. The second white band begins just behind the spiny dorsal fin and widens out to encircle the body behind the pectoral and ventral fins. There is a third white band on the caudal peduncle. The orange fins



A fish of any other genus would be stung, killed and eaten, but the Clownfishes enjoy immunity. Photo by Robert P. L. Straughan.

are edged with brown, with a white border on the very edge. The charm of these colors lies in the fact that they do not blend into each other, but the white bands look as if they were painted on the orange body. This fish is often found in friendly company with large Sea Anemones, and their association must be of mutual benefit. The Sea Anemone could easily make a meal of these little morsels which use the Anemone as a shelter and like to swim among the poisonous tentacles, but it allows the Clown Fish to enjoy perfect immunity.

SIZE: 4 inches.

SCIENTIFIC NAME: *Amphiprion polymnus* Linnaeus.

POPULAR NAME: White-tailed Clown Fish.

RANGE: Throughout the tropical Indo-Pacific.

DESCRIPTION: This fish has caused quite a bit of confusion among ichthyologists because of the different forms in which it is found. The mature fish which grow to about 5 inches, have a white tail



There must be a good reason for this partnership, but nobody can do more than guess. Photo by Robert P. L. Straughan.



Sometimes *Amphiprion sebae* assumes a chocolate brown color, like this one. Photo by Dr. Herbert R. Axelrod.

and two broad white bands running around their body. Their overall color ranges from a deep orange to a chocolate brown to a black depending upon the region from which they come. Juvenile specimens under two inches look like the juveniles of several other species, notably *A. bifasciatus*. The adult forms differ from *A. sebae* in that the second band does not go completely through the dorsal fin and the first band doesn't "scoot" the eye.

Amphiprion akallopis is a handsome yellow Clownfish with a white stripe. Photo by Dr. Herbert R. Axelrod.





Amphiprion latilavatus is an attractive, hardy species. Photo by Earl Kennedy.

A pair of **Amphiprion latilavatus**. The upper fish is the male. Photo by Gene Walfsheimer.





Tamato Clowns, *Amphiprion ephippium*. Photo by Robert P. L. Straughan.



Amphiprion ephippium is a very hardy species. Photo by Dr. Herbert R. Axelrod.

We seldom get to see this one, ***Amphiprion bicinctus***. Photo by Dr. Herbert R. Axelrod.





Amphiprion perideraion has a more modest coloration than most of the Clownfishes. Photo by Dr. Herbert R. Axelrod.

Three Common Clownfish, **Amphiprion percula**, and under them a Blue Demoiselle, **Abudefduf coeruleus**. Photo by Robert P. L. Straughan.

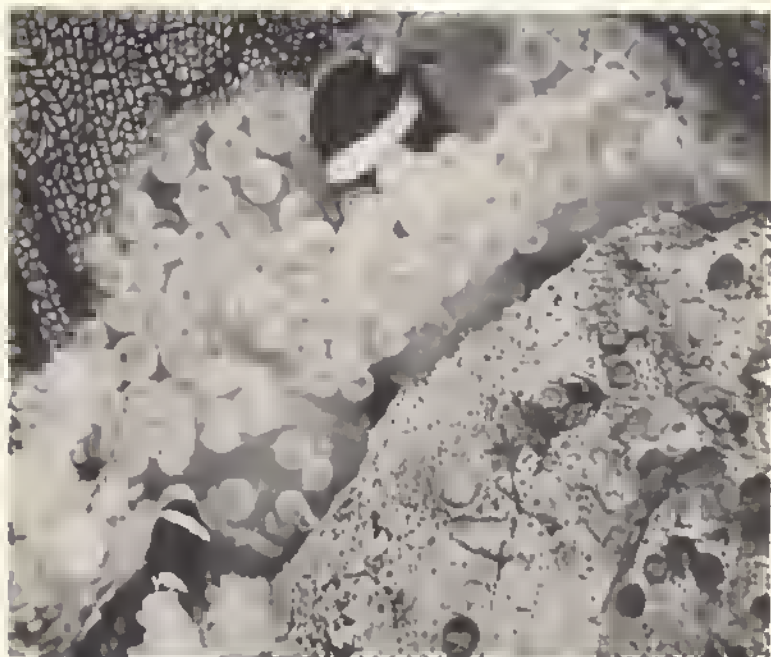




Amphiprion tricinctus, the Three-Banded Clownfish. Photo by Dr. Herbert R. Axelrod.

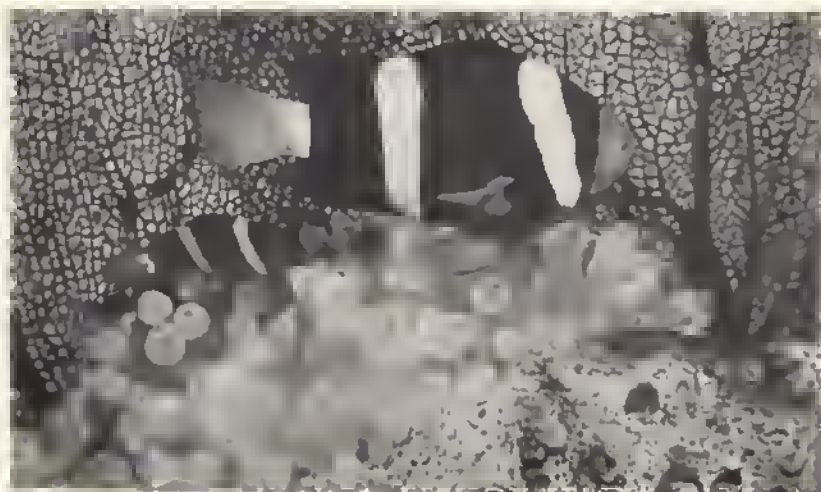
Amphiprion xanthurus. Photo by Dr. Herbert R. Axelrod.





This close view shows a pair of Clawns actually touching the stinging ends of an anemone's tentacles with perfect immunity. Photo by Gerhard Budich.

Any other fish would avoid the onemone like the plague, but the Clawfish are fond of it! Photo by Gerhard Budich.





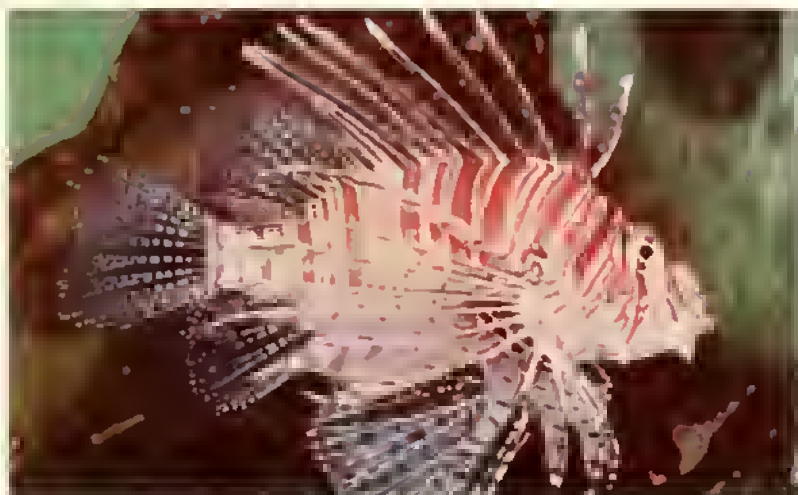
A handsome Clown is *Amphiprion sebae*. Photo by Gene Wolfsheimer.



Hypsypops rubicunda, with a mantis shrimp below. Photo by Gene Wolfsheimer.



A young pair of *Hypsypops rubicunda*, known in California as the Garibaldi Perch. Photo by Gene Wolfsheimer.



Pterois lunulatus, one of the Lionfishes.

The Scorpion Fishes

Family *Scorpaenidae*

The members of this large family are generally too big to be of interest to the marine aquarist. They have a nightmarish appearance, and some are brightly marked, which of course makes them interesting as well as colorful. In their natural surroundings, some of them are regarded with fear, for a very good reason. The sharp dorsal spines of the *Pterois* species are capable of inflicting painful wounds. These spines are hollow, and have poison sacs at their base. Even a small amount of this poison in the system can cause horrible agony, and has often resulted in death. Therefore, handle this fish as you would a cobra; stay away from the spines! In other ways, these fellows can be quite fascinating; they become very tame, and will soon swim to their owner when he approaches the tank, if they know it is feeding time. They prefer living fishes as food, but can be easily trained to take strips of fish from your fingers.

These fishes are provided by nature with another peculiarity, namely dermal flaps. These are loose bits of skin which hang from various parts of their anatomy, usually around the head. These are aids to camouflage, which wave around in the tide when the fish is motionless, looking like bits of seaweed clinging to a rock.



Dendrochirus brachypterus. Photo by Gene Wolfsheimer.

Dendrochirus zebra. Photo by Dr. Herbert R. Axelrod.





Pterois antennata. The Pterois species are just as poisonous as they are beautiful.

SCIENTIFIC NAME: *Dendrochirus zebra* Bleeker.

POPULAR NAMES: Zebra Fish, Scorpion Fish.

RANGE: Red Sea, eastern Africa, Polynesia.

DESCRIPTION: The head is bright orange, except for six unusual markings in the eye. These are deep black, and radiate from the pupil of the eye. The upper three extend from the pupil to the edge of the eye, and the other three extend downward, two into the cheek and one ending at the upper lip. There are also dermal flaps about the head, and the body has alternating vertical bars of brown and orange. The dorsal spines are just as long and sharp as with *P. volitans*, and probably just as dangerous. The pectorals are not quite as big, but are round and bluish in color, with four zigzag vertical markings.

SIZE: 8 inches.



Pterois miles. Photo by Dick Boyd.

Pterois radiata. The first dorsal spines are hollow and carry poison sacs.



SCIENTIFIC NAME: *Pterois lunulatus* Bleeker.

POPULAR NAMES: Zebra Fish, Scorpion Fish.

RANGE: Red Sea, eastern Africa, Polynesia.

DESCRIPTION: This fish is almost a duplicate of *Pterois volitans*, with a few minor distinctions: there are fewer dermal flaps, and the spiny dorsal and pectoral fins are a mite shorter. The entire body is rosy in color, with darker vertical bars. The pectoral has a great many dark spots, and three dark streaks cross the ventral fins. The other fins are rosy in color and otherwise unmarked.

SIZE: 10 inches.

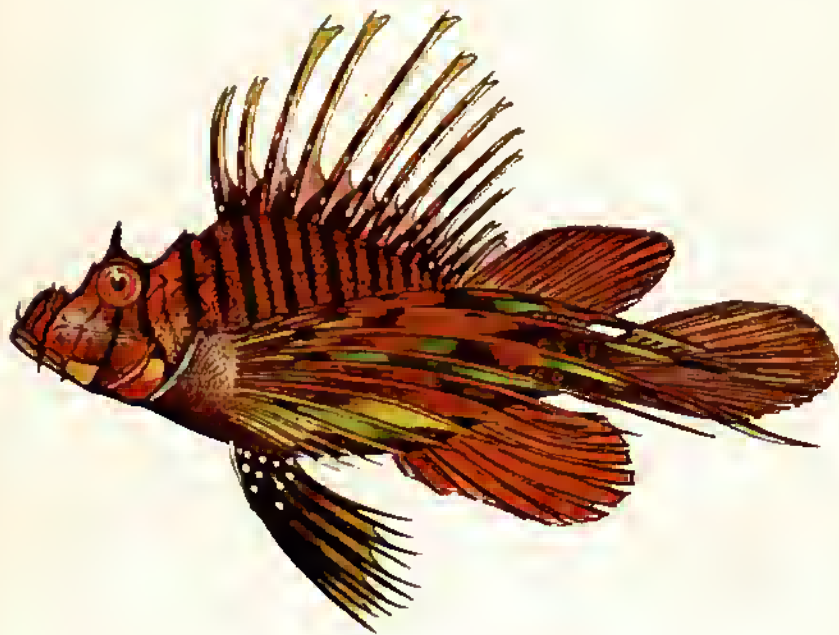
SCIENTIFIC NAME: *Pterois volitans* Bleeker.

POPULAR NAMES: Zebra Fish, Turkey Fish, Lion Fish, Feather Fish, Scorpion Fish.

RANGE: Red Sea, eastern Africa, Polynesia.

DESCRIPTION: This is the species usually offered to aquarists. There are vertical stripes from the tip of the nose to the end of the

Pterois russelli, Russell's Lionfish.





Pterois volitans, the most commonly imported of the group. Photo by Dr. Herbert R. Axelrod.

tail. These stripes are alternately white and rich brown, and a narrow streak of pink divides the white stripes. There are dermal flaps about the mouth and head, and the immense black and white striped pectoral fins are a thing to behold. When held out at right angles to the body, they hide all but the head, as seen from the front. The dorsal spines are very long and dangerous. The rays, as well as all the other fin rays, are alternately black and white. This gaudy little nightmare of a fish has to be seen to be properly appreciated. Its unusual appearance makes it an eye-catcher.

Size: 10 inches.

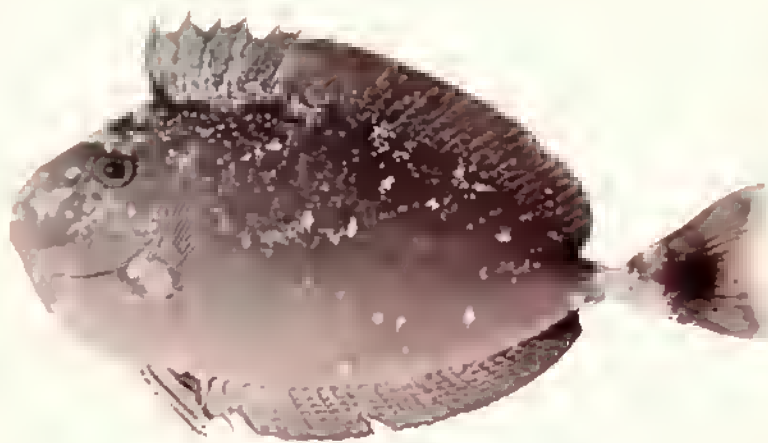
Tangs, Surgeon Fish and Doctor Fish

Family *Acanthuridae*

This familiar group of fishes does not contain the toy fishes which are usually so desirable for the marine aquarium in the home. But they are, nevertheless, very popular. The outstanding physical

Top to bottom: *Naso lituratus*, *Holacanthus tricolor* and *Acanthurus lineatus*. Photo by Hans and Klaus Paysan.





A young specimen of *Naso brevirostris*. Photo by Dr. Herbert R. Axelrod.

characteristic of the group of Surgeon Fishes, or Tangs, is the spine (or pair of spines) to be found at the base of the tail. These spines are sharp and dangerous and extreme care should be taken not to handle these fishes without heavy, wet gloves, or in a very heavy net. The chief food of the Surgeon Fishes is algae, and they should be offered small pieces of partially cooked spinach or lettuce leaves. Along with their extremely sharp spine at the middle of their caudal peduncle, they are famed for their poisonous spines on their dorsal, anal or pelvic fins. Normally this poisonous characteristic is found only on the larval forms of these fishes, but the author was very painfully burned whilst handling one species preparatory to photographing it in Ceylon. This family is a large family and is strictly a tropical marine fish which does best in water which does not fall below 80°F.

The family is made up of about six genera: *Acanthurus*, *Paracanthurus*, *Ctenochaetus*, *Naso*, *Hepatus* and *Zebrasoma*. They have been called Surgeon Fish, Lancet Fish, Tangs, Unicorn Fish, Doctor Fish, and a variety of Hawaiian names.

SCIENTIFIC NAME: *Acanthurus achilles* Shaw.

POPULAR NAMES: Pakuikui, Achilles' Tang.

RANGE: China coast, throughout Micronesia and Polynesia to the Hawaiian Islands.

DESCRIPTION: The body is such a deep brown that it is almost black. There is a bright scarlet diamond-shaped area near the caudal base, and another scarlet area in the tail. The same color also adorns the base of the dorsal and anal fins, and there is a blue patch on the chin and gill-plate.

SIZE: 10 inches.

SCIENTIFIC NAME: *Acanthurus bariene* Lesson.

POPULAR NAMES: Pualu, Maikoko.

RANGE: Mauritius, through the East Indies, Micronesia and Polynesia to the Hawaiian Islands.

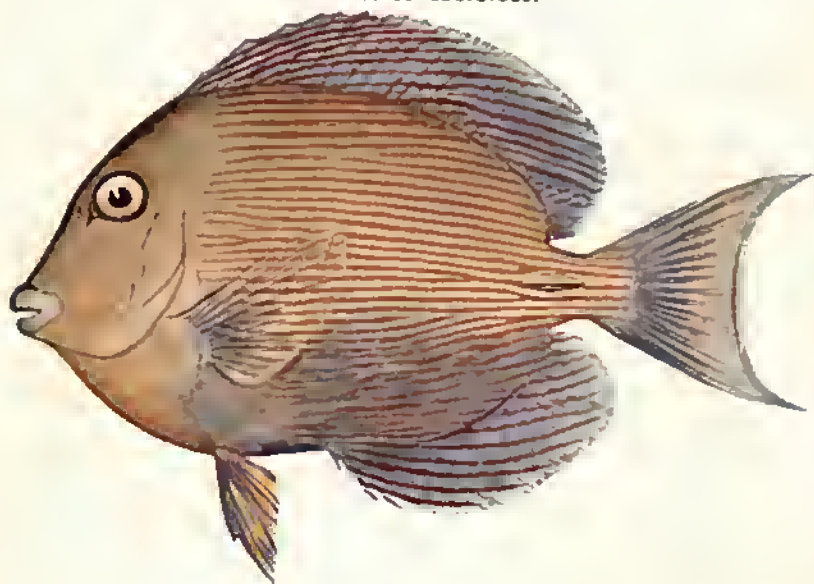
DESCRIPTION: The Pualu is bluish, with a golden iridescence. There are many fine lines which cross the body horizontally. The dorsal fin has a golden line at its base, the anal fin a bluish line at its base and the tail is blue, covered with small black dots.

SCIENTIFIC NAME: *Acanthurus dussumieri* Cuvier and Valenciennes.

POPULAR NAME: Surgeon Fish or Palani (Hawaiian).

RANGE: Throughout the Pacific from southern Japan to Australia to the Philippines, Hawaii and South Africa.

Acanthurus coeruleus.





Acanthurus dussumieri becomes large when mature, and it is practical to keep only young ones. Photo by Dr. Herbert R. Axelrod.

DESCRIPTION: The color photograph of this species is a bit deceiving. In Nature the fish has a black spotted, bright blue tail. The body is accented with fine lines in a contrasting blue. The band about the eye runs from yellow to golden orange and the spine on the caudal peduncle is white with a black outline. This fish must be handled with care as the spine is very sharp, as are the numerous teeth. This fish grows to 1½ feet in length.

SCIENTIFIC NAME: *Acanthurus elongatus* Lacepede.

POPULAR NAME: Pualu.

RANGE: Widely distributed throughout Oceania.

DESCRIPTION: Dark brown in color, with a black spot at the posterior dorsal and anal fin edges.

SCIENTIFIC NAME: *Acanthurus guttatus* Schneider.

POPULAR NAME: Maiko.

RANGE: From Mauritius and Reunion through Melanesia, Micronesia and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: Body is of a dark brown color, with a dorsal and anal fin which is slightly larger than those of most of the other members of the family. There are 4 wide, lighter colored vertical



bars, and the posterior half of the body, as well as the dorsal and anal fins, is dotted.

SIZE: Up to 12 inches.

SCIENTIFIC NAME: *Acanthurus leucopareius* Jenkins.

POPULAR NAME: Maikoko.

RANGE: Throughout Melanesia, Micronesia and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: Dark brown body, with the only adornment a light band through the head just behind the eye, and another at the caudal base.

SIZE: 8 inches.

SCIENTIFIC NAME: *Acanthurus leucosternon* Bennett.

POPULAR NAME: Powder-blue Surgeon Fish.

RANGE: Uncommon, but widespread throughout the Indo-Pacific tropical waters.

Acanthurus leucosternon in its natural surroundings. Underwater photo by Dr. Wolfgang Klausewitz.





A closer look at *Acanthurus leucosternon*. Photo by Dr. Herbert R. Axelrod.

DESCRIPTION: The excellent color photograph of this fish was taken in Honolulu by the author where he was rather surprised to find it among the catch of a local fisherman. There is no record of the fish having been found as far as Hawaii, its usual haunts being closer to Ceylon and the Indo-Australian coral islands. This is one of the most beautiful of the Surgeon Fishes and most of the specimens caught are under six inches in length.

SCIENTIFIC NAME: *Acanthurus nigricans* Linnaeus.

POPULAR NAME: Black Surgeon Fish.

RANGE: Central Indo-Pacific.

DESCRIPTION: Not a large fish, the usual specimen being about 8 inches. This is a rather rare species and does not trap readily with other species. It is not often seen close to shallow coral reefs where the author has most of his experience, but it does find a suitable ecological niche in the deeper lagoons. It takes a baited hook readily. In young specimens the sides are barred with black. The photograph shows a mature specimen about maximum size.

The Convict Tong, *Acanthurus triostatus*. Photo by Dr. Herbert R. Axelrod.





Acanthurus nigricans. Photo by Dr. Herbert R. Axelrod.

SCIENTIFIC NAME: *Acanthurus olivaceus* Schneider.

POPULAR NAMES: Naenae, Orange Spot Tang.

RANGE: East Indies, Micronesia and Polynesia. Abundant in Hawaiian waters.

DESCRIPTION: The body color is olive, shading to bluish toward the belly. Just behind the eye, an orange stripe extends back halfway down the body. The tail is black, with a vertical orange stripe.

SIZE: Up to 12 inches.

SCIENTIFIC NAME: *Acanthurus trigosteus* Linne.

POPULAR NAMES: Manini, Convict Tang, Convict Fish, Hinalea.

RANGE: Widely distributed; abundant throughout Polynesia: from Mauritius, Reunion and Seychelles, through the East Indies, Queensland, Melanesia, Micronesia and Polynesia as far as the Hawaiian Islands.

DESCRIPTION: Body color varies somewhat from silvery to a light tan, with 8 horizontal black bars crossing the sides.

SIZE: Up to 9 inches.

SCIENTIFIC NAME: *Acanthurus xanthopterus* Cuvier and Valenciennes.

POPULAR NAMES: Purple Surgeon Fish, Yellowtailed Surgeon Fish.

RANGE: Restricted fairly closely to the Hawaiian Islands.

DESCRIPTION: This is a very variable species which has a bright purple body and a yellow tail while in its juvenile form (under three inches). It is easily distinguished, even in adult coloration, by the yellow on the outer half of the pectoral fins and the uniform purple of the body.

SCIENTIFIC NAME: *Ctenochaetus strigosus* Quoy and Gaimard.

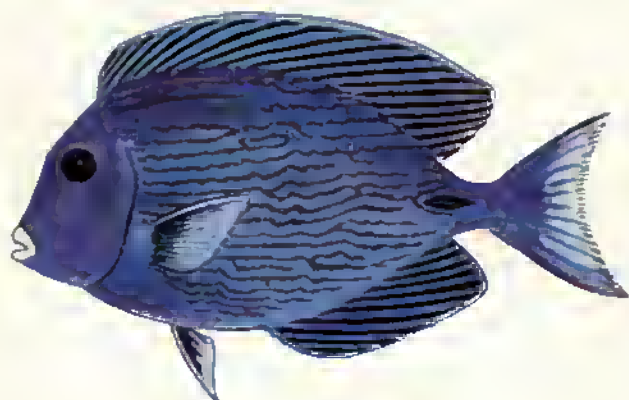
POPULAR NAME: Kala.

RANGE: Red Sea and Ceylon to Zanzibar and the East Indies, through Micronesia, Melanesia and Polynesia to the Hawaiian Islands.

DESCRIPTION: The Kala was once tabu as food to all but the king, and a death penalty was imposed upon anyone else who ate it. It is a coppery red in color and has about 30 fine horizontal lines of light blue.

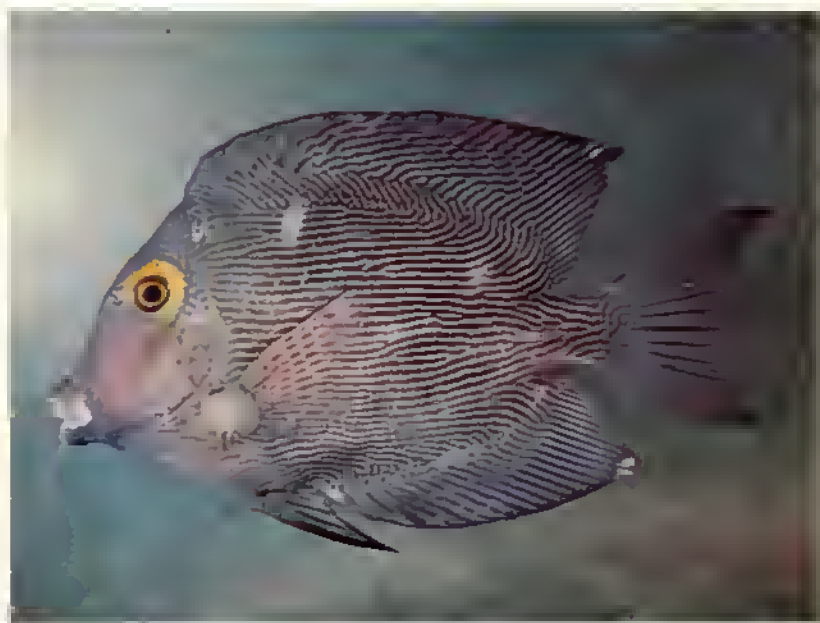
Outstanding in its color contrasts is *Acanthurus xanthopterus*.





The Blue Tang, from Florida waters.

Ctenochaetus strigosus is known to the natives as the Kala. Photo by Dr. Herbert R. Axelrod.





The Yellow Tang, *Zebrasoma flavescens*, is a stand-out in any aquarium. Photo by Dr. Herbert R. Axelrod.

SCIENTIFIC NAME: *Zebrasoma flavescens* Bennett.

POPULAR NAMES: Lauipala, Yellow Tang, Yellow Surgeon Fish.

RANGE: East Indies through Melanesia, Micronesia and Polynesia to the Hawaiian Islands.

DESCRIPTION: The snout is quite pointed, and the color varies from brownish in specimens from Polynesia, where it is quite common, to a brilliant chrome yellow in specimens from Hawaiian waters.

SCIENTIFIC NAME: *Zebrasoma veliferum* Bloch.

POPULAR NAMES: Kihikihi, Api, Sailfin Tang, Kihikihi Launui.

RANGE: Madagascar, Mauritius, Reunion and the Seychelles through the East Indies, Micronesia, Melanesia and Polynesia to the Hawaiian Islands.

DESCRIPTION: There is no mistaking this one, with its beautiful high dorsal and anal fins. Body color is very changeable, from dark gray to very light, and a series of 8 vertical bars cross the body.

SIZE: Large specimens may attain 16 inches.



***Zebrasoma xanthurus*.** Photo by Dr. Herbert R. Axelrod.

The Sailfin Tang, ***Zebrasoma veliferum***. Photo by Dr. Herbert R. Axelrod.



The Sea Horses

Family *Syngnathidae*

These charming little creatures are practically a "must" for the marine aquarist. They have so many unusual characteristics that it is difficult to decide where to begin. Of course, the first thing to be noted is the resemblance of the head, neck and chest to that of a tiny horse. On the back, the small dorsal fin which moves with a quivering motion is the fish's only means of propulsion. The tail is long and prehensile like a monkey's, and is used to anchor the fishes when there is a tide running. Like the Trunkfishes, they have a hard external skeleton.

Their breeding habits are still more unusual; the male (yes, the male) has a pouch across his chest which resembles that of a kangaroo. When the fish are ready for spawning, a pretty courtship takes place which climaxes with the female inserting her ovipositor into this pouch and depositing her eggs, which are fertilized inside by the male. Here they undergo a period of incubation, during which the male's "pregnancy" becomes more and more apparent. Finally the young are popped out one after the other, tiny replicas of their parents. The female should be removed from the tank before the birth of the young; she is not needed. When birth is completed, the male should also be removed; he is likely to mistake his young for food, and treat them accordingly.

Sea Horses have excellent appetites, and there should be some brine shrimp swimming in their tank almost constantly. The larger specimens can be tempted to vary their diet occasionally with live baby guppies, or an occasional white worm feeding. Being slow swimmers, they are very likely to be outsmarted at feeding time if other fishes are kept with them, and are best kept in their own quarters. They also need something to hold onto; a few branches of coral or some well-washed sticks will do nicely.

Because of their healthy appetites, special care should be taken to keep their tank free of wastes and bits of uneaten food. Keep a filter running constantly, and clean it often, besides keeping a frequent watch for debris in the tank. Also watch for shells of brine shrimp eggs. Be careful not to get any into the tank; the rough, sharp edges of the indigestible shells could cause enough intestinal damage to result in death.

This is an excellent fish for the beginning marine aquarist.



A pair of Sea Horses, *Hippocampus hudsonius*. The male (on the left) has the brood pouch, in which he incubates the eggs. Photo by Lilo Hess.



During copulation the female inserts her ovipositor into the brood pouch of the male. Photo by Lilo Hess.



The male's pouch has become widely distended, and the young are beginning to hatch. One is seen emerging. Photo by Lilo Hess.



Seo Horses with their young. Photo by Dr. Herbert R. Axelrod.

SCIENTIFIC NAME: *Hippocampus hudsonius* DeKay.

POPULAR NAME: Northern Sea Horse.

RANGE: Charleston to Cape Cod.

DESCRIPTION: This is the northern species of Sea Horse, one which can sometimes be collected by aquarists in the New York area. It is a very unpredictable species, however, common one year and almost non-existent the next. In appearance, all Sea Horses are very much alike. This one, being larger than the other species, generally requires more food than the average aquarist can provide. Brine shrimp are a bit too small when newly hatched, and the Sea Horses will not touch food which does not move. If the aquarist lives near the seashore and can supply small shrimp, baby minnows and the like, his *H. hudsonius* will thrive nicely. The inland aquarist will have to resort to raising baby guppies for food, and tempting the Sea Horses with an occasional feeding of Tubifex or white worms, making sure there is no surplus to die in the salt water and cause foulness.

SIZE: 10 inches.

SCIENTIFIC NAME: *Hippocampus zosterae* Jordan and Gilbert.

POPULAR NAME: Dwarf Sea Horse.

RANGE: Florida and the Gulf Coast, common in Pensacola Bay.

DESCRIPTION: Of the two species usually available, this species is the one recommended. It is smaller, and much easier to feed. Newly hatched brine shrimp are readily accepted, and an occasional baby guppy tidbit is always appreciated. This species has also proven to be more hardy, and will breed more readily.

SIZE: 2 inches.

The most difficult part of caring for Sea Horses is providing food, especially in adequate quantity. They will eat only living organisms. The larger Sea Horses will eat salt marsh mosquito larvae, marine crustacea, newly-born live-bearers or similar-sized fishes or insects, or adult brine shrimp. None of these foods is easily available to aquarists with the possible exception of new-born guppies.

Providing for the dwarf Sea Horses, however, affords little problem; newly hatched brine shrimp will suffice throughout their life cycle.

New-born dwarf Sea Horses are as big or bigger than new born Sea Horses of other species, and all can handle brine shrimp. One



These three Sea Horses are all the same species and show some of the color phases encountered. Photo by Stan Wayman and Rapho Guillemette.

must, however, be sure to provide plenty, for most Sea Horses are terrific eaters; some have been calculated to consume 3600 brine shrimp in a ten hour feeding period. Also, they have been found to kill all they can after having eaten their fill, otherwise, the shrimp would probably live 2 to 3 days. (A note of caution: No egg shells or unhatched eggs can be tolerated, for they are indigestible and block the intestines.)

To successfully maintain any of the various species of Sea Horse, you must provide: places for grasping (coral, dried branches, glass or plastic rod, etc.), adequate food, and peaceful tank mates. (Aggressive tank mates will gobble all the food intended for the slow-moving Sea Horses, hence the latter will generally do better in a tank of their own.)

It is somewhat more difficult to maintain pure sea water than synthetic sea water.

The reason is that changes occur in the concentration of the trace chemicals (which are so important in maintaining marine life) and the pH decreases, due to utilization of the available alkalis in the neutralization of acids produced by fish waste and decomposing food. Uneaten food particles may decay and cause growth of micro-organisms, such as bacteria, which rapidly brings about the undesirable condition we know as foulness. The double need of quickly removing waste matter and excess food is thus clear. Fouling occurs especially rapidly at higher temperatures.

Since Sea Horses are used to water in motion, it is best to provide aeration. Aeration of a gentle sort will do, for strong currents will not allow the Sea Horses to catch their food. Also, Sea Horses will not eat in dim light.

Though Sea Horses have been bred in captivity, results are more sure if you obtain newly caught pregnant males, and attempt to raise their young.

The dwarfs start breeding in late February and continue on through to Fall. Ten days are required from fertilization to the birth of the young. In two to three days the males are ready to breed again. The usual size brood is 25, with 55 apparently near the maximum. (Large Sea Horses have an incubation period of about 1½ months.)

Male dwarf Sea Horses are likely to take air bubbles into their pouches when pumping them up in preparation for breeding. Since the bubbles cause them to lose their balance, this makes breeding difficult or impossible.



A rarity, an albino Sea Horse. Sea Horses show a number of different colors. Photo by G. J. M. Timmerman.

With large Sea Horses, a white spot disease occasionally occurs. It first appears on fins, ends of cirri, etc. Those beneath the skin then mushroom, causing loss of pigment and appear as white areas. This fatal disease is a microsporidian related to *Glugea* and is probably a specific disease of Sea Horses and Pipefish, as no other fish has been seen with it. Isolation helps to prevent spreading to other Horses, but no cure is known.

The most frequent trouble with Sea Horses is gas bubbles. Though they do not seem to bother the animal too much, they often disturb the fish's equilibrium. All that is necessary is to puncture the bubble with a sharp, sterile instrument and press or squeeze out the gas. In the pouches of large pregnant Sea Horses the gas usually is due to stillborn young; in dwarfs the bubbles are best released during courtship or after the birth of the young, as the pouch is then dilated. In young fish, gas bubbles are fatal.

Sea Horses are known for their powers of regeneration. We have noted several Sea Horses, with fins so badly nipped by puffers that the fish could swim only by violent body contortions, yet were swimming normally again in one week, and in two weeks signs of previous injury were not apparent. The large Sea Horses have probable life expectancies of two to three years, the dwarfs somewhat less.



The Sea Horse uses its long tail to good advantage, most usually as a gripping mechanism. Photo by Earl Kennedy.



The Pipefishes are closely related to the Sea Horses. Photo by A. van den Nieuwenhuizen.

The Pipe Fishes

Family *Syngnathidae*

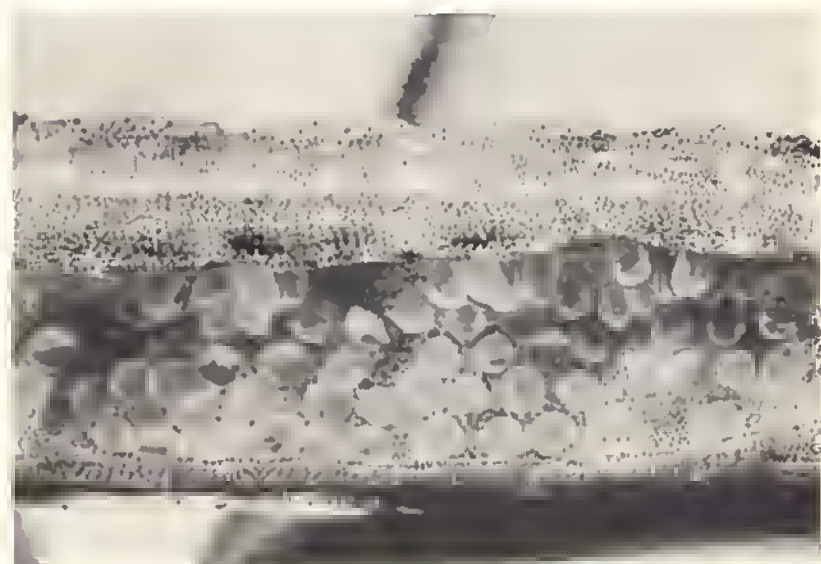
These fishes will be seen to be of the same family as the Sea Horses, but have been listed here separately because of their different appearance. Their long, slender bodies often lead to confusion with the Gars, but there is actually a very great difference between the meek little Pipe Fish and the predatory Gar.

Known all the way from the Nova Scotia coast to North Carolina, the Northern Pipe Fish is much more easily found in the New York area during the summer months than its cousin, the Sea Horse; dragging a seine almost anywhere in a bay where there is some plant growth will produce Pipe Fish nearly every time. While the Pipe Fish does not have the classic horse-like appearance, it is just as interesting. The body is long and slender, sometimes mottled and sometimes almost black in color. There is a small dorsal fin, tiny pectoral fins, no anal fin and only a small excuse for a tail fin. The



Instead of a brood pouch, the Pipefish male carries a series of flaps along its belly. Photo by A. van den Nieuwenhuizen.

The distended flaps are now packed with eggs. Photo by A. van den Nieuwenhuizen.



head is slender, the snout long and the mouth small. The male is provided with a brood pouch similar to that of the Sea Horse, and spawning is accomplished in the same unique manner. The natural spawning period is late spring and early summer.

SCIENTIFIC NAME: *Syngnathus fuscus* Storer.

POPULAR NAME: Northern Pipe Fish.

RANGE: Halifax to North Carolina.

DESCRIPTION: See description above. The Pipe Fish will also refuse any food which does not move, but will readily accept brine shrimp.

SIZE: 7 inches, usually much smaller.



Two Pipefish
eggs which are
about to hatch.
Photo by
A. van den
Nieuwenhuizen.



Bathygobius fuscus. Photo by Gene Wolfsheimer.

The Gobies

Family *Gobiidae*

The Gobies are a family of fishes which occur in many parts of the world. Some inhabit fresh water; others are found in brackish water, and some lead a purely oceanic existence. They are usually small in size, which makes them candidates for the aquarium; sometimes this is their only attribute. With the exceptions described here, they are usually dull in color, and most of them are of a rather retiring temperament, preferring to hide behind or under things, and not swimming about much.

In their natural environment, they usually fasten themselves to a rock or some other debris, which they are able to do by making a sucker disc of their ventral fins, and waiting for their food to be washed to them. In the aquarium, they often fasten themselves to the glass sides or rocks. However, sometimes they can be seen perching on larger fishes! The other fishes soon grow used to this treatment, and even seem to like it.

SCIENTIFIC NAME: *Bathygobius fuscus* Ruppell.

POPULAR NAME: Oopu Ohune.

RANGE: Red Sea, Mozambique, Mauritius, India, the Andamans, East Indies, along China and Queensland, through Melanesia, Micronesia and Polynesia to the Hawaiian Islands.

DESCRIPTION: This is one of the more active and colorful Gobies. It is reddish brown in color, peppered with bright blue spots.

SIZE: 4 inches.

SCIENTIFIC NAME: *Kelloggella oligolepis* Jenkins.

POPULAR NAME: Goby.

RANGE: Hawaiian Islands and Easter Island.

DESCRIPTION: This Goby has a dusky color. There is a horizontal stripe along the middle of the sides, and many vertical lines cross this stripe, giving it a series of rectangular dark markings. This is not a very active species.

SIZE: About 1 inch.

SCIENTIFIC NAME: *Elacatinus oceanops*.

POPULAR NAMES: Neon Goby, Blue Goby.

RANGE: West Indies north to the Florida Keys.

DESCRIPTION: This Goby is strikingly marked with a bright blue horizontal stripe extending from the tip of the snout to the base of the tail. This stripe is accentuated by a broad black border on either

A black Goby species from the Philippines. Photo by Gene Wolfsheimer.



side, and there is a pink area in the gill region. This fellow is not as lazy as most of the other family members, and makes a most attractive aquarium fish. A carefully selected pair will get along beautifully with each other and their tank-mates, but an incompatible pair is very likely to squabble. It is best to get a number of small ones and raise them together.

Size: $3\frac{1}{2}$ inches.

The Blue-Banded Goby, *Lythrypnus dalli*. Photo by Gene Wolfsheimer.



The Goatfishes

Family *Mullidae*

These are sometimes offered to marine aquarists as young specimens. The colors run mostly to a bright red, and they are easily recognized by their long barbels, or whiskers, on the lower lip.

SCIENTIFIC NAME: *Mullus auratus* Jordan and Gilbert.

POPULAR NAME: Northern Goatfish.

RANGE: West Indies to Florida, occasionally straggling northward.

DESCRIPTION: Mostly reddish gold in color, with lighter fins. A bottom feeder.

SIZE: 8 inches.

SCIENTIFIC NAME: *Pseudupeneus chrysonemus* Jordan and Evermann.

POPULAR NAME: Goatfish.

RANGE: Throughout the Hawaiian Islands.

DESCRIPTION: One of the smaller Goatfishes; the upper part of the body is deep scarlet, becoming lighter beneath. The barbels of this species are yellow.

SIZE: 8 inches.

SCIENTIFIC NAME: *Pseudupeneus multifasciatus* Quoy and Gaimard.

POPULAR NAMES: Moano, Red and Black-Banded Goatfish.

RANGE: From India and the East Indies through Melanesia, Micronesia and Polynesia to Hawaii, where it is very common.

DESCRIPTION: The upper part of the body is deep rosy red, becoming lighter below. There is a black stripe which runs through the eye from the upper lip, and a black area on the back extending to the end of the spiny dorsal fin. The lower half of the soft dorsal is black. Four black bars of varying widths extend about halfway down the sides, and the ventral and anal fins are tinged blue. A very handsome fish.

SIZE: 10 inches.

SCIENTIFIC NAME: *Upeneus maculatus* Bloch.

POPULAR NAME: Spotted Goatfish.

RANGE: West Indies to Florida.

DESCRIPTION: This rather handsome fish is bright red in color, with three black blotches on the sides.

SIZE: 12 inches.

The Spotted Goatfish, *Upeneus maculatus*.





The Yellow Goatfish, *Upeneus martinicus*.

SCIENTIFIC NAME: *Upeneus martinicus* Cuvier and Valenciennes.

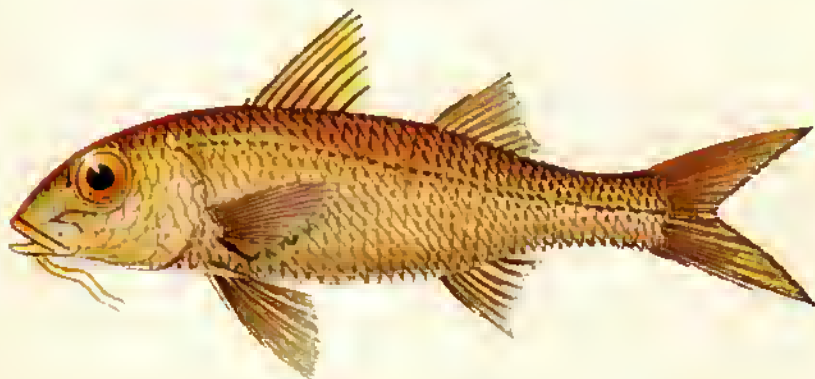
POPULAR NAME: Yellow Goatfish.

RANGE: West Indies to the Florida Keys.

DESCRIPTION: The most handsome of the American Goatfishes; the sides are red, and there is a bright yellow streak which extends from the top of the head above the eye to the base of the tail.

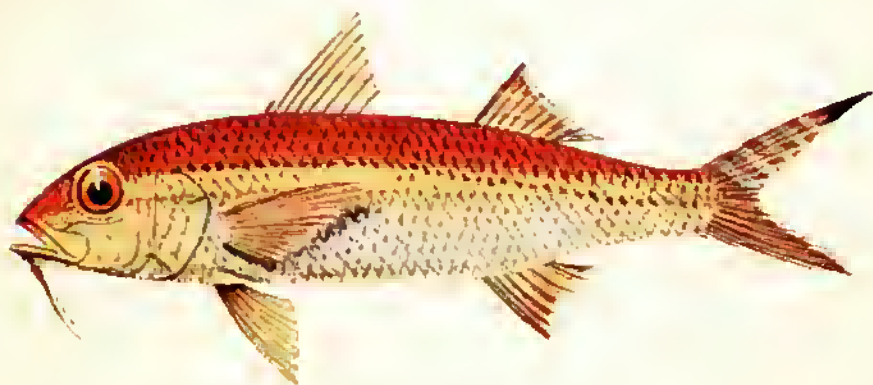
SIZE: 16 inches.

Mulloidés vanicolensis.

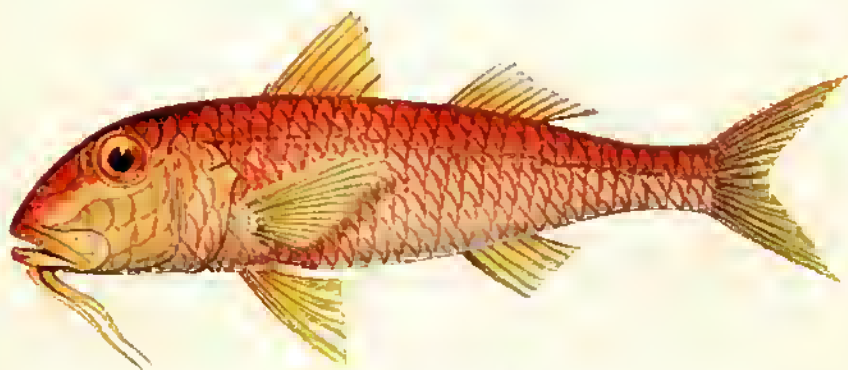




Upeneus fragula.



Upeneus maluccensis.



Parupeneus jausene.



Upeneus vittatus.

Parupeneus macranemus. Photo by Dr. Herbert R. Axelrod.



The Monodactylids

Family *Monodactylidae*

These are round, compressed fishes with big eyes and tiny scales. Although they have no bright colors to adorn them, they are nevertheless very popular among aquarists. They can be raised in fresh water as well as in a marine aquarium. The dorsal and anal fins are unusual: the first rays are elongated into round tabs, and these "tabs" are covered with scales.

SCIENTIFIC NAME: *Monodactylus argenteus* Lacepede.

POPULAR NAME: Mono.

RANGE: Indian Ocean.

DESCRIPTION: Body is shiny and silvery in color. The dorsal and anal fins are edged with black. There are two vertical bars, one through the eye, and the other from the first dorsal rays through the base of the pectoral fins to the belly.

SIZE: 4 inches.

Monodactylus argenteus is not a strictly marine species. It can be adapted to fresh water as well.





Monodactylus sebae is found along the west coast of Africa, near river mouths. Photo by Dr. Herbert R. Axelrod.

SCIENTIFIC NAME: *Monodactylus falciformis* Lacepede.

POPULAR NAMES: Cape Lady, Moonfish, Kitefish, Seakite and Mono.

RANGE: Throughout the Indo-Pacific.

DESCRIPTION: This is not necessarily a tropical fish, though cold kills it in great numbers; and it is not necessarily a marine fish, as they live nearly equally well in fresh water. Though they can take the change to fresh water very well, it is probably better to make the change gradually.

SCIENTIFIC NAME: *Monodactylus sebae* Cuvier and Valenciennes.

POPULAR NAMES: Mono, Moonfish.

RANGE: West Africa in tropical waters usually close to fresh-water rivers.

DESCRIPTION: A very beautiful and desirable species collected by the author (HRA) in great quantities in the rivers around Douala, Cameroons. They are found in all sizes from 2 inches to 7 inches and all do very well in fresh water or marine water. For food, they prefer frozen brine shrimp, but they also take pelletized foods readily.

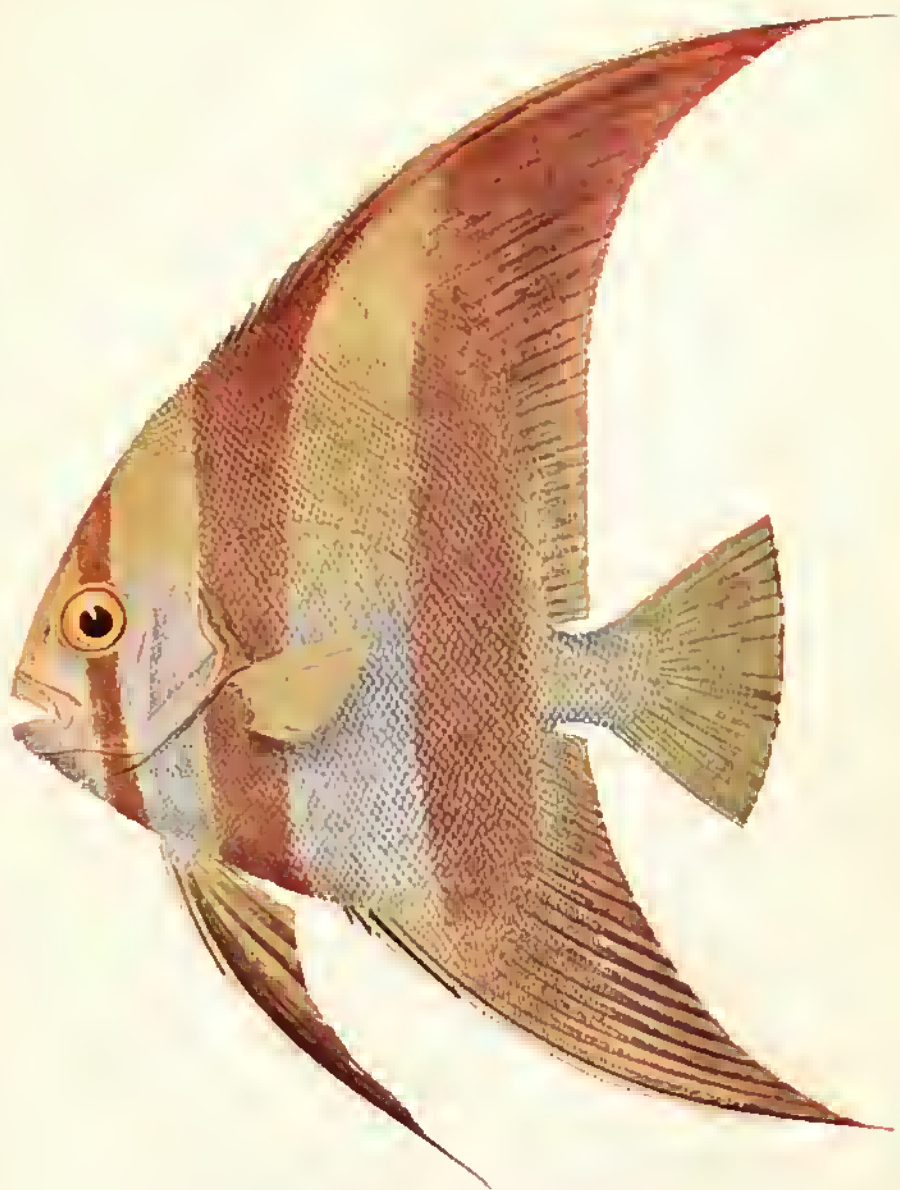
The Bat Fishes

Family *Platacidae*

These are "ancient" looking fishes which are found in the tropical marine waters of the Indo-Pacific. They are rare, not school fishes, and are always sought after as prize specimens because they develop into "personality fishes" in the home aquarium. The author grew a *Platax orbicularis* from a two inch specimen to a 15 inch specimen

Platax batavianus, mature specimen.

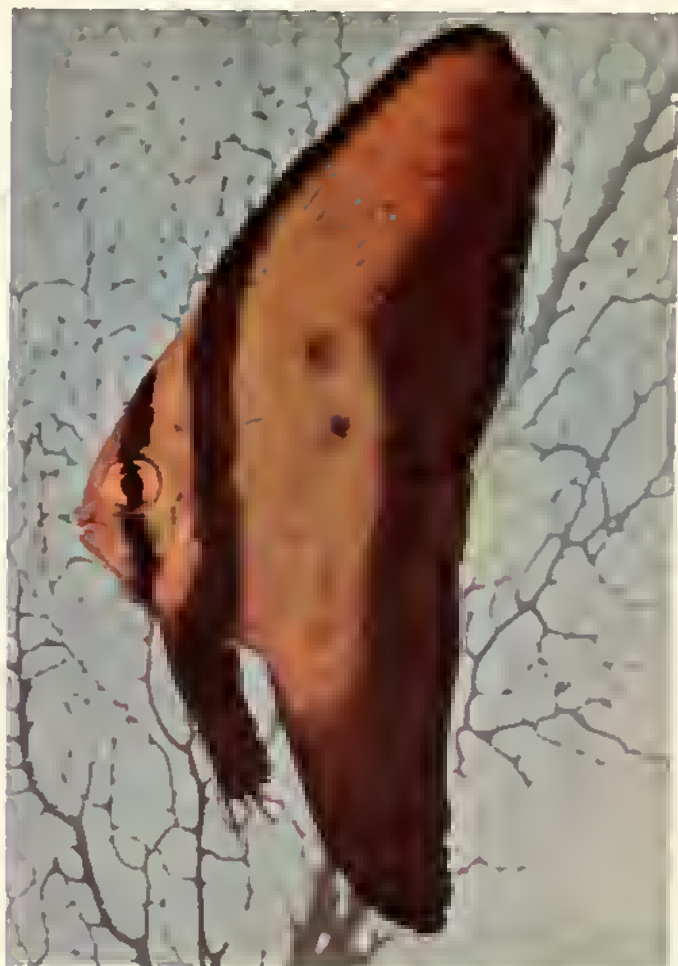




Platax batavianus, young specimen.

in less than one year. The fish became so tame that he would actually poke his mouth out of the water for food and would appreciate having his sides rubbed. They will always become tame if trained to take food from your fingers. They do well on all types of food, but they especially appreciate a few live Guppies now and then. They will readily accept anything, even Goldfish pellets. The more they eat the faster they grow. Their appearance from juvenile to adult stage is a remarkable metamorphosis.

A young Balfish, *Platax orbicularis*. Photo by Earl Kennedy.





The Batfishes are usually the first on hand at feeding time. Photo by Earl Kennedy.



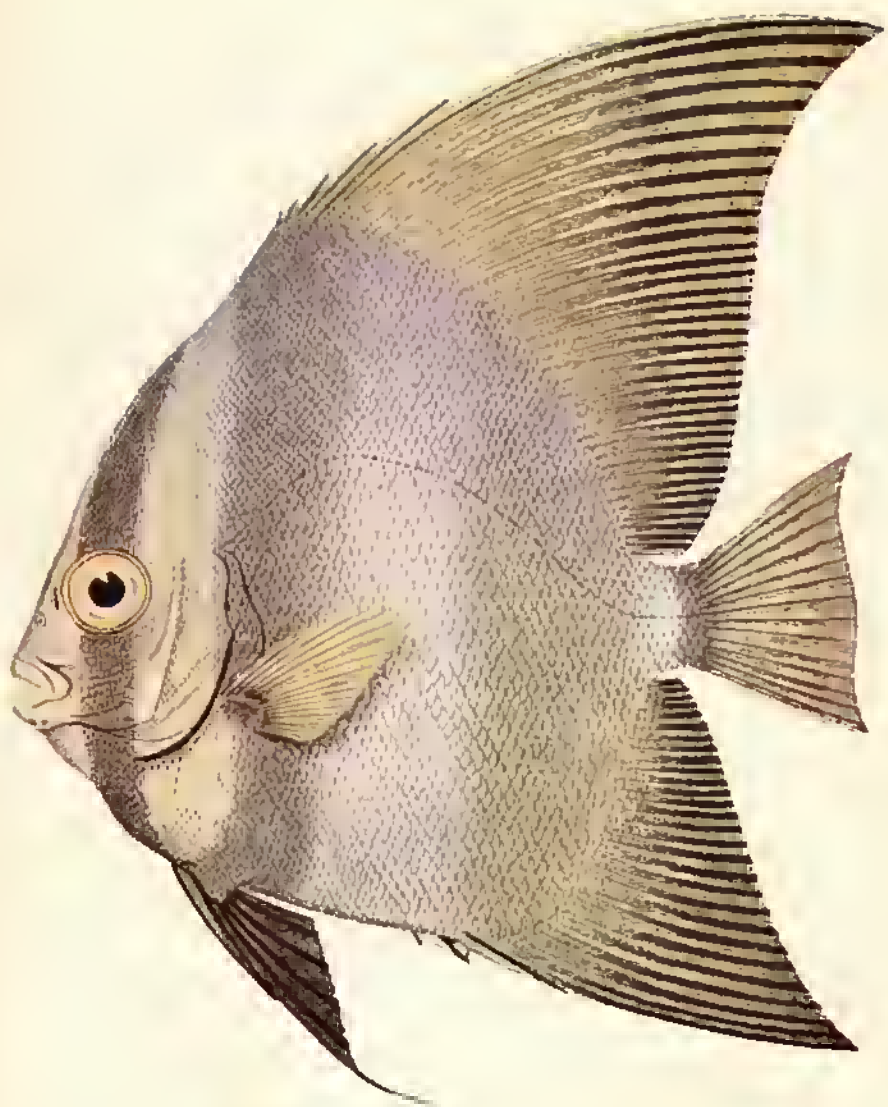
Platax orbicularis. Photo by Dr. Herbert R. Axelrod.



Platypus pinnatus
Photo by Earl Kennedy

Platax teira.
Photo by Earl Kennedy.





Platax vespertilia has shorter fins than the others.



Therapon jarbua. Photo by Gunter Senfft.

The Theraponids

Family *Theraponidae*

Some of our marine species are able to ascend rivers and live in brackish or even fresh water. This fish is one of them. It is possible to keep it in fresh as well as salt water. It is quite hardy, but inclined to be somewhat quarrelsome.

SCIENTIFIC NAME: *Therapon jarbua* Forskal.

POPULAR NAME: Stripecy.

RANGE: Red Sea, East Coast of Africa to China and the Northern Coast of Australia.

DESCRIPTION: Body color is silver, with three unusual horizontal stripes. Looking down upon the fish, these lines will be seen to form three ovals. The spiny dorsal has a large black spot, and there are three horizontal lines in the tail fin.



The Spotted Scat, *Scatophagus argus*, often ascends rivers and can be acclimated to fresh water.

The Scats

Family *Scatophagidae*

Here we have another family of fishes which sometimes travel far upstream, so far in fact that they can be kept in fresh as well as salt water. They are a common sight near the river mouths in some of the East Indian seaports, grubbing around the docks and boats in search of any kind of edible garbage they can find. Do not take this as an encouragement to feed them garbage, however. They require a considerable amount of vegetable matter in their diet to keep them completely happy, it has been found. They are in their glory when fed an occasional meal of duckweed, with spinach or lettuce as an acceptable substitute. Of course, the regular menu fed to the other fishes should not be forgotten, either.

SCIENTIFIC NAME: *Scatophagus argus* Pallas.

POPULAR NAME: Spotted Scat.

RANGE: East Indies.

DESCRIPTION: There are at least three color variations of this fish. One has a silvery body, covered with large round black spots. The second has a much greater number of small black spots on a brown background. The third, which is believed by some to be the male coloring rather than a variation, has a number of vertical stripes on the front half of the body, followed by some spots. There are also some orange-red markings about the head, making it a very attractive fish.

SIZE: In nature, about 10 inches; in the aquarium, seldom exceeds 4 inches.

SCIENTIFIC NAME: *Scatophagus tetracanthus* Lacepede.

POPULAR NAME: Scat.

RANGE: East Africa to East Indies and Australia.

DESCRIPTION: The shape is a little longer than the preceding fish, and the body color is a light silver. Markings on the sides are variable, vertical bars often breaking up into large black spots.

SIZE: 4 inches.



Scatophagus tetracanthus combines bars and spots in a pleasing pattern.



The False Scat, *Selenataca multifasciata*. Photo by Gene Walfsheimer.

Note how *Micrognathus strigatus* swims with its head down, making the slightly diagonal stripes horizontal. Photo by Dr. Herbert R. Axelrod.





The Gobies are an interesting and frequently comical group. This one is *Rupiscartes atlanticus*, the Rock Skipper. Photo by Dr. Herbert R. Axelrod.

Here *Rupiscartes* gives us a sly and very alert smile. Photo by Dr. Herbert R. Axelrod.





Ever see a fish with eyelashes? The Rock Skipper has them. Photo by Dr. Herbert R. Axelrod.

The Croakers

Family *Sciaenidae*

Almost all of this family consists of fishes which are too large to be of interest to the aquarist. However, there is a small group which may find favor.

SCIENTIFIC NAME: *Eques acuminatus* Bloch and Schneider.

POPULAR NAMES: Cubbyu, Highhat.

RANGE: North Carolina to Brazil.

DESCRIPTION: This species is not so much distinguished by any brilliant colors; it is merely striped black and white. Its claim to distinction is the unusually long dorsal and ventral fins. The first rays of the dorsal are long and ribbonlike, black with white edges. The ventrals are also similarly colored and trail down gracefully.

The Ribbonfish, *Eques lanceolatus*, has an interesting finnage and color pattern. Photo by Robert P. L. Stroughon.



These fishes are a bit shy, and take quite a while to get used to life in the aquarium. During this time, there should be enough food provided for them in the form of brine shrimp.

SIZE: 10 inches.

SCIENTIFIC NAME: *Eques lanceolatus* Linnaeus.

POPULAR NAME: Ribbonfish.

RANGE: West Indies northward to Pensacola, Florida.

DESCRIPTION: An attractive little fish. Against a light background, there are three brown stripes. The first goes from the eye to the corners of the mouth; the second curves down from the top of the head to the ventral fins, and the third from the beginning of the dorsal fin to the caudal base. The fins are also colored brown.

SIZE: 10 inches.

SCIENTIFIC NAME: *Eques pulcher* Steindachner.

POPULAR NAME: Striped Ribbonfish.

RANGE: West Indies to the Florida Keys.

DESCRIPTION: This species has short fins. There are three longitudinal stripes which run the length of the body.

SIZE: 8 inches.

The Jacks or Pompanos

Family *Carangidae*

Most of these fishes are unsuitable as aquarium specimens, either because of their size, or because they are too active for a life in a confined space. There are a few, however, which are sometimes available as young specimens, and are very interesting in shape.

SCIENTIFIC NAME: *Alectis ciliaris* Bloch.

POPULAR NAMES: Thread Fish, Cobbler Fish, Sun Fish, Shoemaker, Ulua Kihikihi.

RANGE: Very widely distributed in warm waters; found both in the Atlantic and Pacific.

DESCRIPTION: You could never confuse this fish with any other. It is a silvery fish, marked with dark vertical bars, usually four in number. Its claim to distinction is the fact that the first rays of the dorsal and anal fins are extended in long, thread-like streamers

which are longer than the fish itself. An interesting oddity in the aquarium.

SIZE: Maximum length about 7 inches.

SCIENTIFIC NAME: *Vomer setapinnis* Mitchill.

POPULAR NAME: Moonfish.

RANGE: Atlantic coast from Brazil to Cape Cod.

DESCRIPTION: Here is another oddity. Color is uniformly silvery, but the head is very high and blunt, giving it a very sad and grouchy expression. Body is very thinly compressed, and fins are short.

SIZE: Wild specimens attain 12 inches in length.

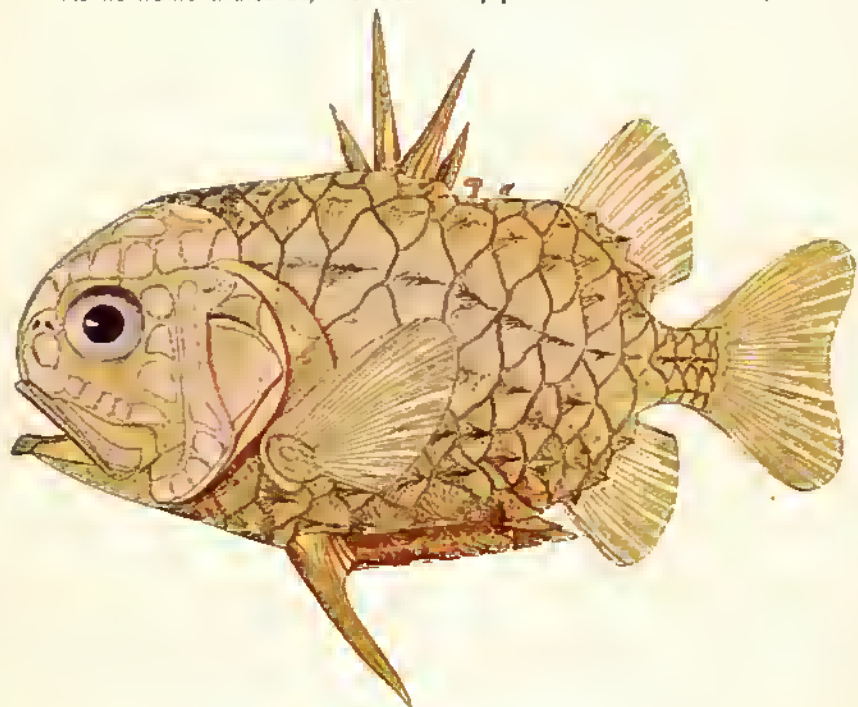
SCIENTIFIC NAME: *Selene vomer* Linnaeus.

POPULAR NAME: Look-down.

RANGE: Atlantic coast from Brazil to Cape Cod.

DESCRIPTION: Almost a duplicate of the preceding in color, but

As its name indicates, *Monocentrus japonicus* is native to Japan.



the head is even deeper and almost vertical, giving it a distorted appearance. First rays of the dorsal and anal fins are elongated.

Size: Wild specimens attain a length of one foot.

SCIENTIFIC NAME: *Monocentrus japonicus* Houttuyn.

POPULAR NAME: Glowfish.

RANGE: Widespread throughout the Indo-Pacific in 20-100 fathoms of water.

DESCRIPTION: The illustration shows very well the magnificent beauty of this rare fish. Rare because it comes from such deep water.

Argyrops spinifer gets large, but young specimens are quite acceptable.



It does well in large aquaria for a little while. It has huge scales which form a sort of armor coat. On each side of the lower jaw is to be found a phosphorescent organ from which the fish gets its name "Glowfish."

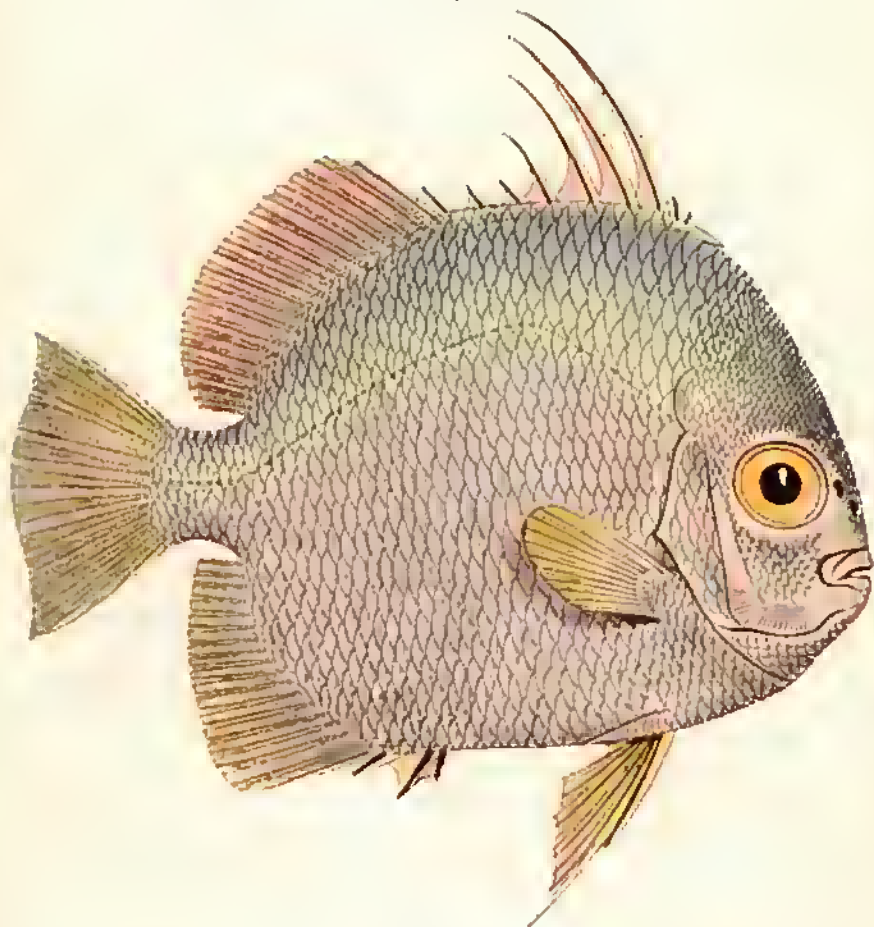
SCIENTIFIC NAME: *Argyrops spinifer* Forskal.

POPULAR NAME: Redfin, miscalled Threadfin.

RANGE: From the tropical waters between India and Singapore and as far south as South Africa.

DESCRIPTION: This very interesting fish grows to almost two feet

The Spadefish, *Tripteronodon orbis*.



in length, but the juvenile stages are most interesting. The fins attain their maximum length when the fish is about 8 months old. After that the body grows but the fish's fins do not, thus the fins are relatively smaller as the fish gets older and larger. They can be dwarfed very easily by keeping them in small tanks and under-feeding them.

SCIENTIFIC NAME: *Tripteron orbis* Playfair.

POPULAR NAME: Spadefish or John Dory.

RANGE: From Natal to Mombasa in South Africa.

DESCRIPTION: This is a very rare and very beautiful fish which is studied by all ichthyologists because of its uniqueness. It is the only member of the genus and is closely related to the Batfish of the genus *Platax*. Large specimens have been known to grow as large as 30 inches and weigh about 20 pounds. They are a prime game fish. They have an amazing habit of lying head up in the water with their mouth open. Tiny fishes come and nibble about their mouth and teeth, presumably cleaning uneaten bits of food from between their teeth. One small specimen, sold in New York by the author in 1952, brought \$200.

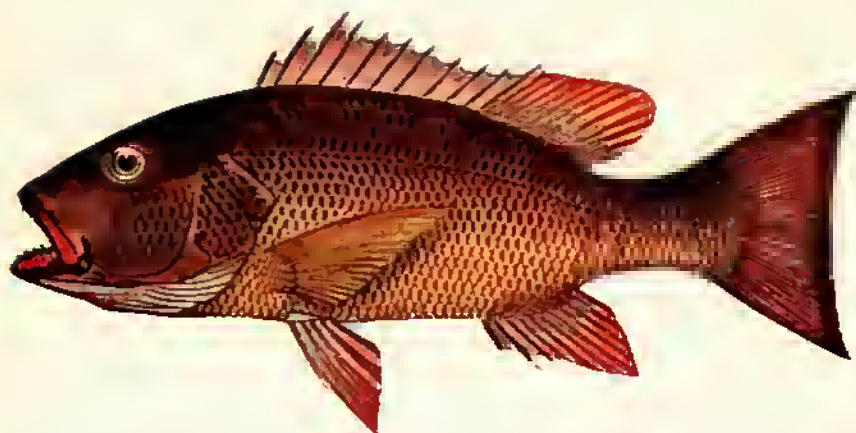
The Snappers

Family *Lutjanidae*

A few of these large fishes find their way into aquaria, especially large tanks maintained by public institutions. Private collectors, though, are often found to prize the juvenile forms of these fishes, because of their intense, high coloration. The Snappers are found mainly in the tropical Indo-Pacific. Most people know the Snapper as a fine, small game fish and a very tasty catch, too. In the aquarium they are hardy, voracious eaters that require a lot of swimming room and copious amounts of live foods. Guppies serve the purpose well and they live in marine aquaria long enough (usually for some days) to be eaten alive. Though only a few species are illustrated here in color, they are not, by far, the most colorful of the available species. Some textbooks have the name *Lutjanus* spelled *Lutianus*. We prefer the spelling *Lutjanus*.

SCIENTIFIC NAME: *Lutjanus argentimaculatus* Forskal.

POPULAR NAME: Red Snapper or Jenoar (in the East Indies).



The East Indies Red Snapper is a popular food fish in its native waters. This one is *Lutjanus argentimaculatus*.

Lutjanus kasmira, from the Indo-Pacific, has a great resemblance to our native Grunt. Photo by Rodney Jonkloas.





This is *Lutjanus sebae*, the Red Snapper. Photo by Earl Kennedy.

RANGE: Common throughout the tropical Indo-Pacific.

DESCRIPTION: This is a large fish that is very popular, not only in the aquarium, but on the table as well. It grows to about 3 feet in length. In their usual habitat they are a blood red in color. Specimens in captivity usually lose their deep red color until they are about to die. As the fish approaches death, it gets redder and redder until when it dies it is the usual blood red it is famous for. This fish easily accommodates itself to fresh water if the change is made gradually.

SCIENTIFIC NAME: *Lutjanus kasmira* Forskal.

POPULAR NAME: Snapper.

RANGE: Throughout Middle Eastern coral reefs to the central Indo-Pacific.

DESCRIPTION: Originally described in 1775 as having come from Arabia, the name "*kasmira*" is a Latinized Arabic name. The usual specimen has light blue streaks bordered by a brown line above and below. The body and fins have a yellow color.

SCIENTIFIC NAME: *Lutjanus sebae* Cuvier.

POPULAR NAME: Red Snapper or Jenoar (East Indies).

RANGE: Throughout the tropical Indo-Pacific as far south as South Africa.

DESCRIPTION: A very colorful fish which grows slightly larger than *argenteimaculatus* and is not nearly as colorful when it is dead . . . but more colorful when alive . . . a terrible paradox.

Groupers and Sea Basses

Family *Serranidae*

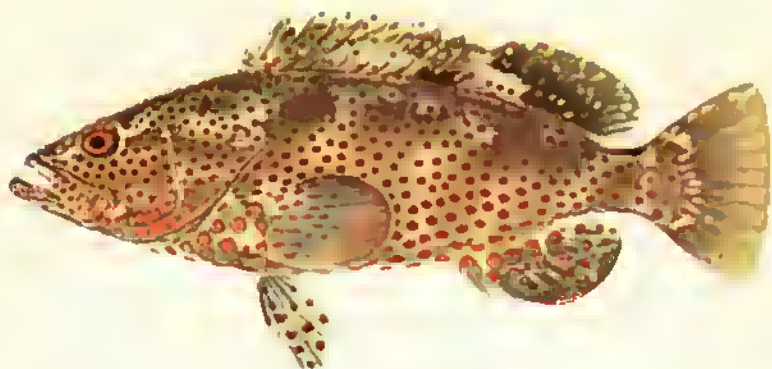
If there is such a thing as a friendly fish, the Grouper would have to take first place. Nearly every skin diver who has made a movie of underwater life has been able to bribe a Grouper, with a bit of food, to be the star of the show. He will swim through hoops, play guessing games (which hand has the food in it), wrestle with the diver and generally make a nuisance of himself by nuzzling the diver while he is taking other underwater scenes. More than one diver had to "cage the beast" so he could continue his work unannoyed once he had befriended a Grouper.

Of course, we are talking about big Groupers. The kind that taste so good as "Grouper Cutlet," my favorite seafood. But the smaller species, and especially the juvenile stages of these smaller species, make very interesting pets in a large marine aquarium.

The world's leading authority on this family is undoubtedly Dr. Leonard P. Schultz, Curator of Fishes at the United States National Museum, and a close personal friend of the author. Dr. Schultz studied these fishes very carefully and made remarkable

Epinephelus maculosus is a Grouper from the West Indies. Photo by Dr. Herbert R. Axelrod.





Epinephelus adscensionis.



A *Dampiera* species from the Philippines. Photo by Earl Kennedy.



Epinephelus morio.

contributions to the systematics of the family in the U.S.N.M. Bulletin 202: "Fishes of the Marshalls and Marianas." Dr. Schultz "concluded that the color pattern of the Groupers is of the utmost importance in distinguishing the various species, but that not too much value should be placed on the presence or absence of the dark vertical bands; these appear to vary in intensity with age, more or less disappearing in adults of certain species. The dark blotches along the back, as well as the distribution of black spots elsewhere on the head and body, are important characters." Only a few specimens of a very large family are illustrated here. There are probably a hundred or more species in this family and they are found in tropical waters all over the world.

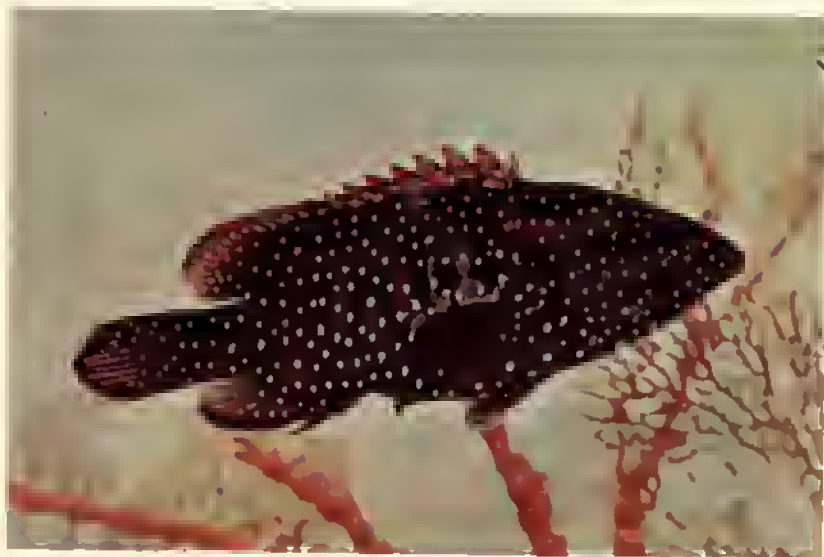
SCIENTIFIC NAME: *Cephalopholis argus* Bloch and Schneider.

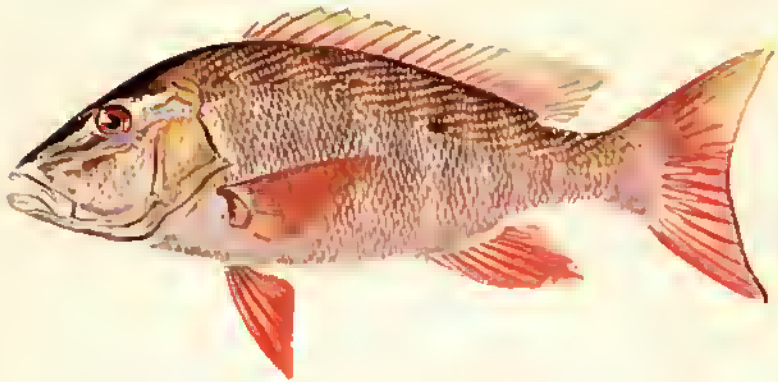
POPULAR NAME: Grouper.

RANGE: Throughout the central Indo-Pacific.

DESCRIPTION: The color photograph by Earl Kennedy of a Philippine specimen he collected shows the physical characteristics perfectly. The background color on older specimens changes from a muddy, chocolate brown to a deep purplish black. The eye has a brownish red iris, not very evident in the illustration.

Cephalopholis argus has an attractive pattern of blue dots. Photo by Earl Kennedy.





Cephalopholis analis is known as the Mutton Fish.

Ever see such bright blue stripes? This is *Cephalopholis boenacki*.
Photo by Dr. Herbert R. Axelrod.





Epinephelus striatus, the Nassau Grouper.



Cephalopholis jactu.



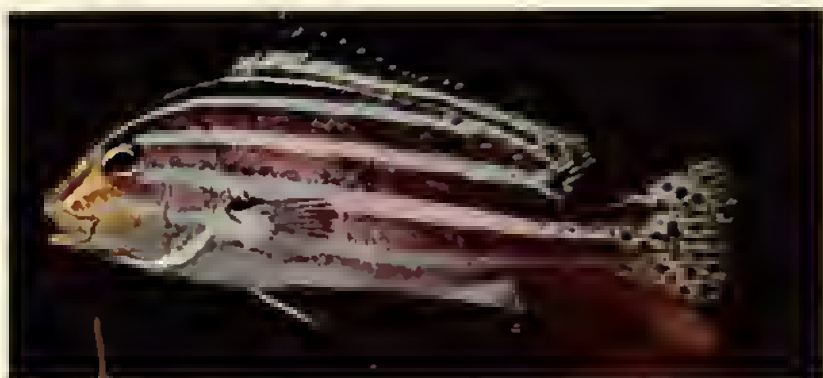
Cephalopholis apodus.



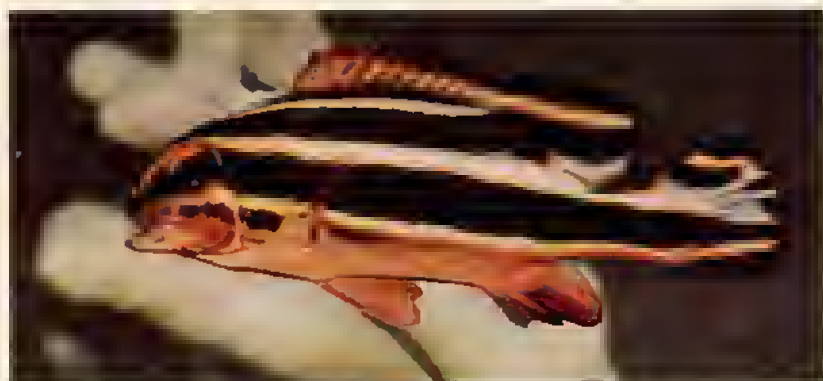
Gaterin pictus. Photo by Dr. Herbert R. Axelrad.

Genus *Gaterin*

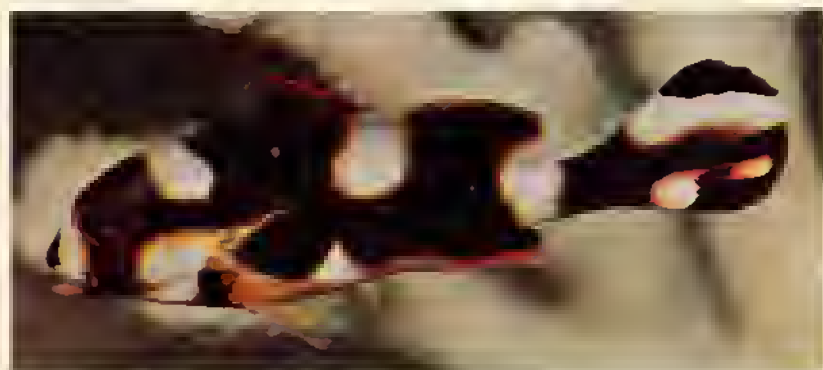
This genus is composed of shallow water species which inhabit most parts of the tropical Indo-Pacific. There is considerable confusion among scientists as to the correct identification of various species because of the severe color changes which the juvenile forms present in various stages of their growth. According to several observers in Ceylon, the juvenile species of some of the *Gaterin* fishes have an extreme tolerance for fresh water and the author saw several specimens of *Gaterin faetela* about three inches long (the adult form reaches 20 inches) at the Lumbini Aquaria, Ceylon. They had been left out in an open aquarium which had been allowed to be diluted by the daily rains. According to Mr. Pererra, the aquarium owner, the fish were now in water which was fresh enough to support fresh-water aquarium plants. This genus contains colorful, hardy and easy to keep fishes, but they require large tanks as they are fast swimmers and heavy eaters. It is not recommended that they be kept in aquaria which are less than ten times as long as the fish. The fish is a favorite food fish all over the world and the juvenile forms are prized as aquarium fishes whenever they can be found.



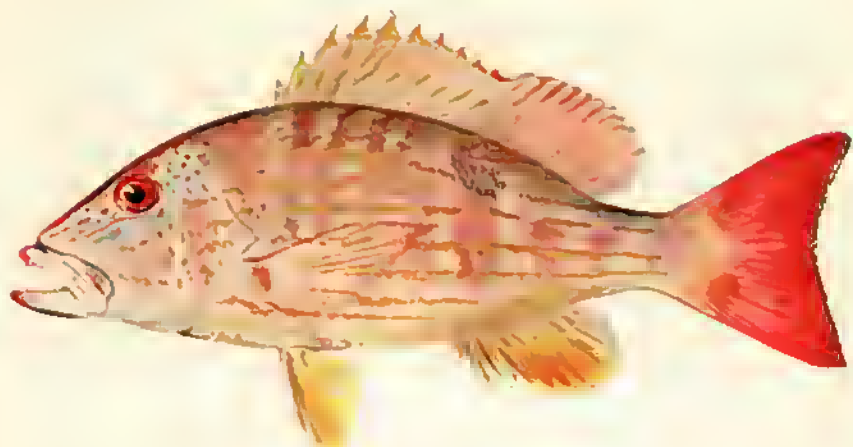
Gaterin albovittatus. Photo by Dr. Herbert R. Axelrod.



Gaterin faetela, young specimen. Photo by Dr. Herbert R. Axelrod.



Gaterin lineatum, young specimen. Photo by Dr. Herbert R. Axelrod.



The Lane Snapper, *Noemaensis synagrus*.

The Man-of-War Fishes

Family *Nomeidae*

These little fish lead a strange life; they are scarcely ever found anywhere but underneath the huge jellyfish known as the Portuguese Man-of-War. Here they find almost perfect protection among the stinging tentacles, which can painfully injure a human being. In the aquarium, they do not quite find themselves at home, and are among the more difficult species to keep.

SCIENTIFIC NAME: *Nomeus gronovii* Gmelin.

POPULAR NAMES: Man-of-War Fish, Rudder Fish.

RANGE: Found in the warm seas of both the Atlantic and Pacific; we have seen them quite frequently in the offshore waters of the New Jersey coast.

DESCRIPTION: Striped with blue and silver; the outstanding characteristics are the large, deep ventral fins, which give rise to the popular name, Rudder Fish.

SIZE: Does not exceed 8 inches.



Centriscus strigatus, the Shrimpfish, usually swims straight up and down.

You will seldom see *Centriscus scutatus* in this position.





Grammistes sexlineatus. Photo by Gene Wolfsheimer.

The Cardinal Fishes

Family *Apogonidae*

Here we have a family of fishes small enough when grown to mature size to be kept in the aquarium. As the name indicates, they are mostly bright red in color. They should not be kept with small fishes, or the population of your tank will decrease rapidly. Although they are not given to harassing their neighbors, they are apt to consider anything which fits into their rather capacious mouths a tasty morsel.

In nature, they are much given to biding in the hollows of large molluscs; they are not parasitic, but merely use these hollows as hiding places. Plenty of hiding places should be provided for these fish. If they know that there are places where they can hide if necessary, they are more likely to show themselves.

Some experts claim that they incubate their eggs in their mouth; perhaps some day an aquarist will prove or disprove that statement; at least the fish is small enough at maturity to breed in an aquarium.

Amia maculatus has a set of black spots which distinguish it. Photo by Wilhelm Happe.





Not all of the Cardinals are red. Here is a black species, *Amia brachygramma*, from the Philippines. Photo by Gene Wolfsheimer.

SCIENTIFIC NAME: *Amia brachygramma* Jenkins.

POPULAR NAME: Cardinal Fish.

RANGE: Samoa and the Hawaiian Islands.

DESCRIPTION: Black, with 5 vertical bands which disappear as the fish gets older.

SIZE: About 6 inches at maturity.

SCIENTIFIC NAME: *Amia erythrina* Snyder.

POPULAR NAME: Cardinal Fish.

RANGE: Southern Polynesia and the Hawaiian Islands.

DESCRIPTION: Uniformly red to bright orange.

SIZE: 2 inches at maturity.

SCIENTIFIC NAME: *Amia frenata* Valenciennes.

POPULAR NAMES: Cardinal Fish, Upapalu.

RANGE: Hawaiian Islands, Guam, and through the East Indies.

DESCRIPTION: Pink to copper-brown above, lighter below. The front edge of the dorsal fin is edged with black, and the second dorsal, anal and caudal fins have a black line running through them.

SIZE: 4 inches at maturity.

SCIENTIFIC NAME: *Amia maculatus* Poey.

POPULAR NAME: Spotted Cardinal Fish.

RANGE: From Brazil to Florida, occasionally straggling northward.

DESCRIPTION: Bright red, with a dark blotch at the base of the second dorsal fin.

SIZE: About 4 inches at maturity.

SCIENTIFIC NAME: *Amia maculifera* Garrett.

POPULAR NAMES: Cardinal Fish, Upapalu.

RANGE: Hawaiian Archipelago.

DESCRIPTION: Pale purple above, shading to a pale orange below. There is a small spot at the tip of the dorsal fin.

SIZE: One of the larger ones; attains 6 inches at maturity.

SCIENTIFIC NAME: *Apogonichthys stellatus* Cope.

POPULAR NAME: Conchfish.

RANGE: From the West Indies to the Florida Keys.

Myripristis murdjan is simply called "Uu" by the Hawaiian natives.

Photo by Dr. Herbert R. Axelrod.





This is the Big-Eye or Conchfish of the West Indies. Photo by Robert P. L. Stroughton.

DESCRIPTION: Bright red, with long ventral fins. This little fish has the strange habit of concealing itself within the mantle cavity of the large Florida conch snail, where it hides and feeds on small crustacea. These fish often conceal themselves in the cavities of sponges.

SIZE: 2 inches at maturity.

SCIENTIFIC NAME: *Mionorus waikiki* Jordan and Evermann.

POPULAR NAME: Waikiki Cardinal Fish.

RANGE: Guam, the Marshall Islands, and the Hawaiian Islands.

DESCRIPTION: This attractive little fish is dark brown in color, with 3 lighter vertical bands on the body. It is much stockier in build than the other Cardinal Fishes.

SIZE: 2 inches at maturity.

SCIENTIFIC NAME: *Myripristis murdjan* Forskal.

POPULAR NAME: Uu or Pauu.

RANGE: Red Sea through the Indian Ocean, the East Indies and Polynesia to the Hawaiian Islands.

DESCRIPTION: The genus *Myripristis* is characterized by a larger head, shorter body and bigger eyes than the *Holocentrus*. The body of this species is red, and the large scales each have a white area. The Hawaiian natives have an interesting manner of capturing this fish: a net is lowered, and a live Uu is hooked and lowered above the net. The others are attracted by the unusual actions of the hooked

We kept these *Apogon nemalapterus* for a long time in our office marine aquarium. Photo by Dr. Herbert R. Axelrod.



fish, and swarm around it. Then the net is raised, with the swarm of fish in it.

SIZE: Up to 1 foot in length in nature.

SCIENTIFIC NAME: *Myripristis pralinius* Cuvier.

POPULAR NAME: Uu.

RANGE: Widely distributed throughout the South Pacific area.

DESCRIPTION: This squirrel fish is red, like the others, but is distinguished by a dark horizontal stripe which runs from the upper part of the gill-cover to the base of the tail fin.

SIZE: One of the smaller species; attains a length of 8 inches.

SCIENTIFIC NAME: *Myripristis chryseres* Jordan and Evermann.

POPULAR NAME: Pauu.

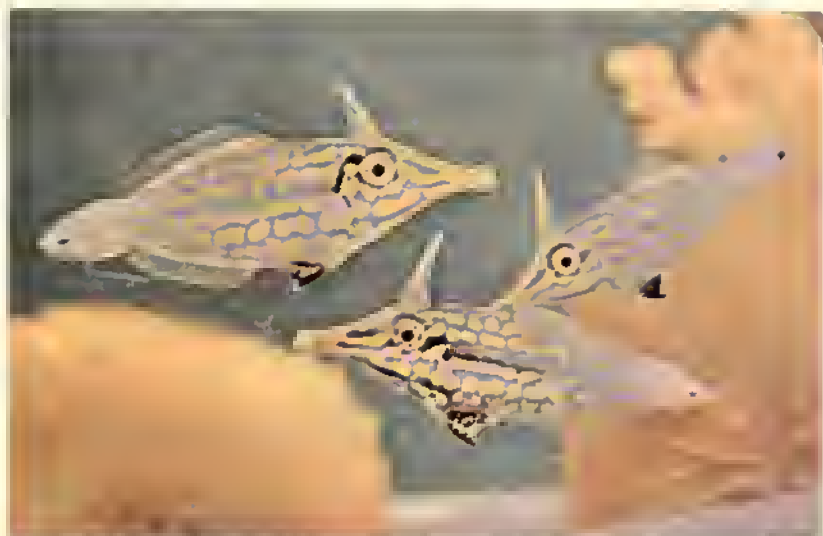
RANGE: Known only in the Hawaiian Islands, but distribution is probably wider.

DESCRIPTION: Deep red, each scale marked with a lighter spot in its center. Yellow fins, with red blotches.

SIZE: Attains a length of 10 inches in its natural state.

Myripristis chryseres. Photo by Dr. Herbert R. Axelrod.





Aren't they the strangest-looking things? These are Orange-Spotted Filefish, *Oxymonacanthus longirostris*, from the Philippines. Photo by Gene Wolfsheimer.

Part of this *Parachinus* species, a youngster, looks as if it has disappeared against a blue background. Photo by Earl Kennedy.





A young specimen of *Plectorhincus chaetodontoides*. Photo by Dr. Herbert R. Axelrod.

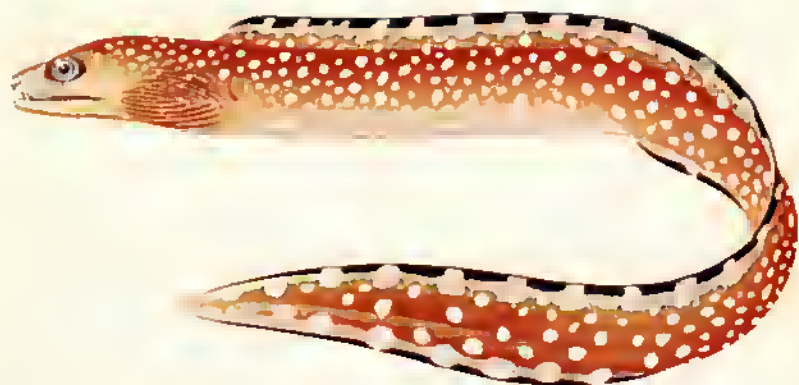


Moray Eels are common in all tropical marine waters. This one is *Muraena helena*.

Moray Eels

Family *Muraenidae*

I was always taught by my Mother: "If you cannot say something nice about somebody, don't say anything at all." I cannot say anything nice about the Moray Eel, so I quote from Dr. J. L. B. Smith: "Moray eels. Robust naked body, sometimes elongate, with thick tough skin. No pectorals. Gill-openings small. Hind nostril above eye. Mouth large, extends behind eye, sometimes not able to close completely. Teeth powerful of various types, sometimes fang-like and depressible. Of all Eels these are the most 'snaky' in appearance and general behavior. Most are aggressive, almost savage, and attack without provocation. Possessed of almost unbelievable strength and ferocity, the larger species are among the most dangerous of all marine creatures, and much dreaded by divers in tropical seas. When working about reefs in warmer seas it is folly to poke a hand into blind crevices, and no pleasant experience to tear loose from the vise-like grip of one of those brutes. They live mainly in and about reefs, and some are brilliantly or strikingly marked." In the aquarium, they do best when they have



Lycodontis jordonii, one of the Spotted Morays.

Looks more like a snake than an Eel, doesn't it? This is *Myrichthys colubrinus*, from the Philippines. Photo by Earl Kennedy.



some large bits of coral to hide in. They stay poised in their hole, waiting patiently for a bit of food to swim by in the form of a small fish, crab . . . or skin diver. The author once shot a Moray Eel with a spear-gun, only to have the Eel slide down the spear and nearly attack the author . . . he never did get that gun back!



Not a very nice fish, but it has a nice pattern: *Echidna nebulosa*.

SCIENTIFIC NAME: *Echidna nebulosa* Ahl.

POPULAR NAME: Diamond-back Moray Eel.

RANGE: Throughout the coral reefs of the Indo-Pacific belt.

DESCRIPTION: There are many slightly different color variations of this fish and they are certainly of interest to ichthyologists who will probably find each geographical race a subspecies. The illustration is of a dead specimen. Living specimens have orange-tipped tails, orange eyes and anterior nasal tubes and the centers of the black blotches are sometimes orange. The Diamond-back has 24 to 30 rows of "diamonds" in two rows. It grows to less than 2 feet in length and when available becomes a very interesting aquarium specimen.

SCIENTIFIC NAME: *Gymnothorax eurostus* Bleeker.

POPULAR NAME: Moray Eel.

RANGE: Central Indo-Pacific.

DESCRIPTION: A long, nasty Moray Eel that is even dangerous in the home aquarium. The author suffered a shock one day when he



Lycodontis tessellata. You have to admit it's nicely marked!

Gymnothorax eurostus, from Hawaii. Photo by Dr. Herbert R. Axelrod.





Lycodontis thrysoidea.

arrived home to be greeted at the front door by a Moray Eel that had pushed off the cover glass and had snaked his way to the front of the house some 50 feet from the aquarium.

SCIENTIFIC NAME: *Myrichthys colubrinus* Boddaert.

POPULAR NAME: Striped Moray Eel.

RANGE: Throughout the tropical Indo-Pacific.

DESCRIPTION: A 3 feet long Eel, completely striped and with feeble, blunt teeth. Its snout projects beyond the mouth. This species buries in the sand in the aquarium and uproots everything. Best kept in an aquarium with some coral pieces without too much sand.

A Blenny species from the Philippines. Photo by Earl Kennedy.



7. Why An Invertebrate Aquarium?

Of the hundreds of people that come into our office, at least half of them quickly look from the marine fishes to the marine invertebrate tank . . . and their eyes stay there. There is such a fascination in these small odd-shaped animals that the question always comes up "Where do these things come from?"

Let me tell you how the invertebrate aquarium got started in the office: One balmy fall day I took my tropical fish class at New York University out to the field to collect some marine fishes. We were particularly interested in Sea Horses, Pipefish and some particularly beautiful black sculpins that are to be found on Long Island (New York). After two or three hours of intensive seining we came up with absolutely nothing! Being in a rather embarrassing position I assembled the group and told them that fate was against us today and that the water was so cold that the fish must have moved to deeper water. At that point one of the students picked up a marine snail.

"What is this," he asked. "I thought snails were only found in fresh water?"

I was astonished! "No," I told him, "snails are common to land, fresh water and the oceans; as are worms and other invertebrate organisms." Immediately the class began looking for more snails and it wasn't too long before they were turning over rocks, looking closely into tide pools and screaming with delight when they uncovered a new form.

After collecting 25 or 30 different invertebrates, we decided to keep them in an aquarium so we could study them further at our laboratory session of the class. So successful was this instruction period that the marine invertebrate aquarium has been with us ever since . . . and it is still the star attraction.



A red anemone, from the Mediterranean.

Sometimes the tank is rather bare and only has a few snails and periwinkles, some small sea anemones, possibly a Man-o-War and a few Hermit Crabs. But most of the time it is full of specimens that the students have collected.

Besides being colorful from an aesthetic point of view, marine invertebrates are so much easier to care for than marine fishes, that they are rapidly gaining in popularity. Hobbyists who can get to the seashore have an unlimited opportunity to study and collect these amazing and beautiful specimens of marine life.

When collecting specimens in a tide pool, you need only a small net, a large net, suitable rubber-soled shoes (to prevent slipping on the slimy, dangerous rocks), suitable containers to carry home the specimens, and some formaldehyde or alcohol to preserve specimens for scientific study.



It is difficult to believe that this is an animal and not a plant!



From Florida waters comes this beautiful anemone. Photo by Robert P. L. Straughan.



Cerianthus membranaceus looks like a tired feather duster.

This green anemone looks as if its tentacles were made of glass.
Photo by Dr. Herbert R. Axelrad.



SEA ANEMONES

In tide pools which are famous for colorful occupants, none can challenge the gaudy beauty of the sea anemones. A sea anemone is a member of one of the major groups of the animal kingdom, the phylum *Coelenterata*. This phylum is broken down further into three classes, namely, the *Scyphozoa* (the jellyfishes), the *Hydrozoa* (the hydroids) and the *Anthozoa* (the sea anemones).

Every coelenterate is outfitted with a characteristic set of stinging cells called, scientifically, nematocysts. These nematocysts are used for paralyzing their food, as the coelenterates are very slow-moving creatures. The action of the nematocysts is much like a triggered spring mechanism, and any brushing movement will cause the threads to spring out and inject poison into the tissue to which contact has been made. In most cases the stinging cells are not sufficiently powerful to penetrate a human's skin, but there are painful exceptions to this rule. Many people are very familiar with



This Portuguese Man-of-War has caught a fish and is preparing to devour it.
N.Y.Z.S. Photo.

the Portuguese Man-of-War, *Physalia*, a hydrozoa (related to the fresh-water *Hydra* familiar to most aquarists), which has stinging cells powerful enough to put a man into the hospital.

Sea anemones, themselves, are equipped with nematocysts and our present knowledge is that none has sufficiently strong nematocysts to inflict any type of wound on a human being. They are usually found adhering to a rock or similar surface. For their attaching device to work, they must have a relatively flat and broad base upon which to anchor. Some species of sea anemones might be found in tidal pools, clinging to pilings, seaweed and eelgrass, while other species live in the mud.

Locomotion among the sea anemones is limited to a slow creeping motion on a pedal disk. Constant observation over a period of 5 to 10 minutes might convince an observer that the anemone is a stationary flower that cannot move, but in reality this animal can really move great distances over periods of weeks or months. The fastest an anemone has ever been "clocked" is 4 inches in one hour. Several exceptional species move about by floating (the *Minyadidae*), while another moves by a flopping method.

The size of sea anemones varies from $\frac{1}{4}$ of an inch, to the 3-foot-wide giant *Stoicactis*, found on the Great Barrier Reef off Australia. Some anemones may live to be 300 years old.

Many hydroids and some close relatives of the sea anemones secrete a calcium exoskeleton (shell) upon and in which the living parts of the animal are protected. These shells give the animal its entire supporting structure. The coelenterates that have this calcium-producing quality are called "corals."

Corals grow, one on top of the other, in great colonies. There are exceptional cases of lone corals. As the innermost corals are smothered they die, and only their calcium skeleton remains to add size and strength to the colony. The feeding heads on the outside of the coral colony are the only truly living part of the colony. Some species of coral reproduce so quickly that they are responsible for great coral reefs and coral islands.

Coral growths are usually classified into three types of formation:

1. The barrier reefs. These are reefs that develop several miles from land and have great depths of water between themselves and the nearest body of land (like the Great Barrier Reef of Australia that is 1,350 miles long and is from 25 to 90 miles from the mainland of Australia).



You can see on **Amphiprion melonopus** among the tentacles of this anemone.

Another of our nicely-colored anemones from Florida. Photo by Robert P. L. Straughon.





These anemones come from the West Indies. Photo by Dr. Herbert R. Axelrod.



Here is evidence of how deadly an anemone can be to its prey. The fish was caught and killed, and will be eaten. Photo RKO Radio Pictures, Inc.

2. Fringing reefs. These are reefs that develop quite close to land and have a very shallow channel between themselves and the nearest land body.

3. Atolls. These are ring or horseshoe-shaped islands, the center of which is a lagoon that is usually not more than 40 feet deep.

Though the relatives of the sea anemones and the hydroids make up most of the calcium part of the atolls, reefs, etc., it has been estimated that the composition of most of the coral deposits is at least 50% plant. It has been proven that there are many calcareous covered plants (covering that contains calcium).

Bearing these facts in mind and without going into the identification of these various coral groups, the only need for the salt water aquarist is to know how to handle any kind of living coral for decorative purposes. Let's assume that you have collected your own piece of living coral. Under the coral, if it was a large, relatively flat piece

(like brain coral), you might have noticed some small worms, or crabs. These must be cleaned. The best way to process the coral is to dry it thoroughly in the air and sun for a week or two at least. After all signs of life have disappeared and the coral is very hard and dry, it can be sterilized. It is best to boil the coral in a solution into which some chlorine bleach has been added. This bleach serves both as a disinfectant and as a bleaching agent. After the coral piece has been boiled for an hour or so it should be allowed to dry out again for a few days after you have washed it thoroughly in cool running water for a few hours. Once it has dried, bathe it again for a few hours in running water and then it is safe to put into your marine aquarium.

If you want treated coral for decoration it is safest to purchase it from your pet shop. The treatment and preservation of coral pieces is a lot of effort and time and is much more costly when done on a piece by piece basis than by volume.

HERMIT CRABS

The nematocysts, the poison cells found in the coelenterates (of which the sea anemones are prominent members), are used by animals other than the coelenterates themselves in a unique bit of animal cooperation.

The small hermit crab, the highly specialized crab which lives in an empty snail shell, is immune to the poison of the sea anemone. It hunts out certain species of sea anemones and, once it has found one, gently tickles the anemone until it leaves the rock or piling to which it is attached. Then the crab maneuvers in such a way as to get the anemone to adhere to its own borrowed palace. With the anemone securely fastened to the snail's shell, the hermit crab goes off looking for food. Now, upon finding itself in the company of small fishes, the crab will provoke the fishes until they come in contact with the stinging cells of the sea anemones. Then both crab and anemone are able to feed.

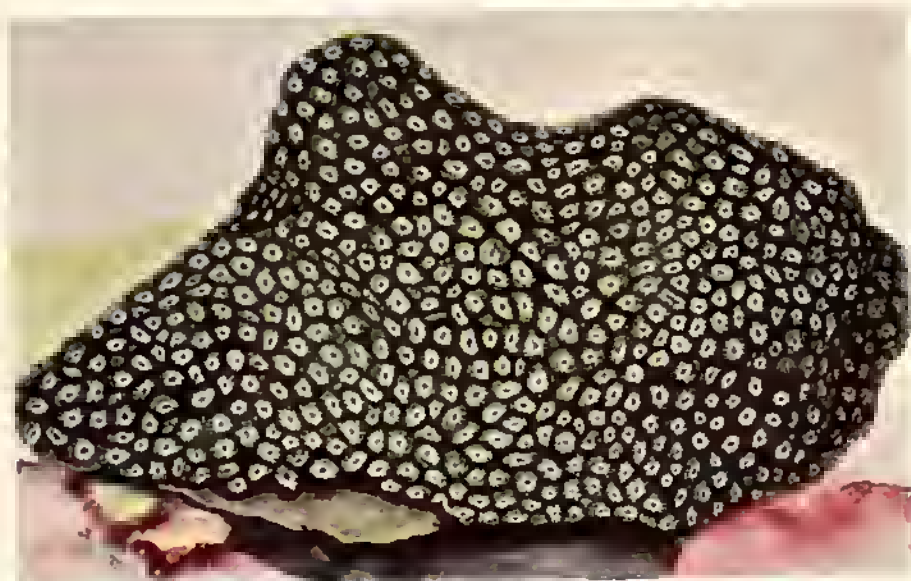
Other species of hermit crabs actually tear a sea anemone loose from its mooring and thrust the animal into the face of an attacker, thus warding off an attack.

BRYOZOANS OR MOSS ANIMALS

The bryozoans, or "moss animals," as they are sometimes called, are a very old group of animals dating back to Cambrian ages



A beautiful coral piece.



When dried and cured, this is known as "brain coral."

Living coral looks a lot different from what we buy. Photo by Dr. Herbert R. Axelrod.



(millions of years ago) and some scientists claim that the bryozoans have lived in the same form for over 500,000,000 years.

It might be difficult really to appreciate the immense beauty of these small animals without a microscope, for each colony is made up of many, many small animals, and each and every one has its own little shell. As soon as some disturbing factor causes a reaction, the moss animals immediately retreat into their shells and pull a door closed behind them.

Each individual moss animal produces an outer protective shell that is either chitinous (horny) or limy (impregnated with calcium carbonate). The colony grows by new members budding off and forming their own little houses, until finally the colony has attained a large size. Most moss animals live on rocks, pilings, seaweeds, shells, other animals, pieces of floating wood, etc.

A great many of them have a very peculiar type of appendage on the side of their shells. These appendages are called *avicularia* because they look like a bird's head complete with a beak. Their avicularia are even equipped with a snapping beak, of which the upper hooked part is fixed and the lower part is movable. These avicularia snap at anything that moves by and their function is probably defensive. Zoologists disagree upon their true function. Though they all agree that the avicularia are used defensively against other incrusting forms, they disagree upon their food-getting powers. They hypothesize that once the avicularia get hold of food, they hold on until the animals die and decompose. Then the decomposition, caused by bacterial action, enables the surrounding members of the colony to feed upon the stray bacteria that fall into their "mouths."

All bryozoans feed either on plankton or detritus. Their tentacles, which are usually arranged in a circle about their mouths, are covered with tiny hair-like cilia. These cilia cause a minute current towards the sticky mucus-covered inner sides of the tentacles where they become tangled and are finally ingested.

Bryozoans have some remarkable powers of regeneration. Their entire digestive system (or most of it anyway) begins to degenerate into a small, dark mass, around which an entirely new digestive tract will develop. Once the new digestive system has become completely formed, the old system will be passed from the body as waste.

WORMS

The word *Annelida* is derived from the word annular; when used in reference to the worms so familiar to all of us, annular indicates a body that is externally ringed.

Worms would probably be the last thing you might want to keep in your marine aquarium, that is, until you've seen the magnificently beautiful "Feather-Duster Worms." These worms look like old-fashioned feather-dusters, with a bunch of feathers tied together at the end of a handle. Actually the Feather-Duster worms live in limey tubes. They usually extend a set of feathery gills from one end of the tube. These gills are ciliated (covered with hair) and cause minute currents, sufficiently strong to swirl microscopic organisms against the worm's slimy film, which traps the small animals and brings them to the mouth of the worm.

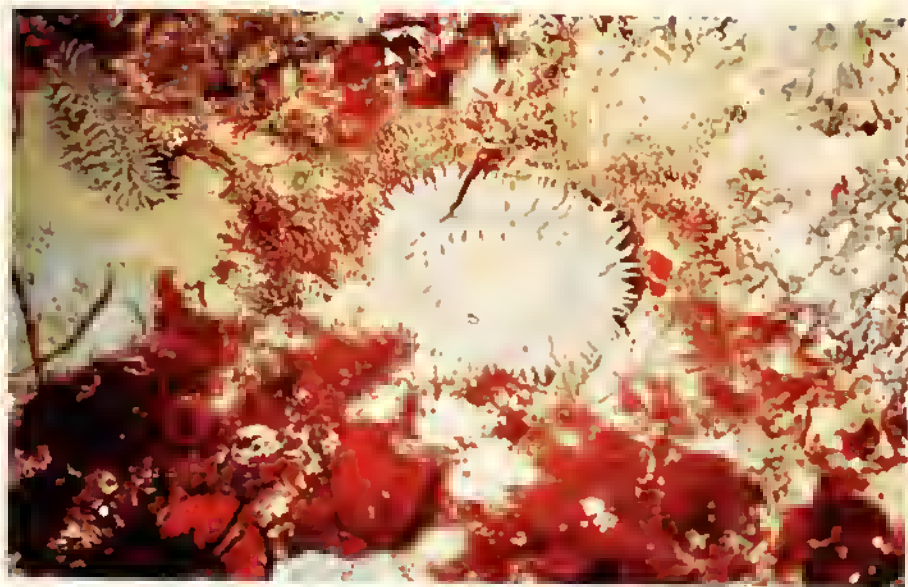
"Feather-Duster Worms" are not the only kind of worms we find suitable for the marine aquarium. There are also the so-called "Peanut Worms." It might be difficult to tell how they got the name "Peanut" if you only see preserved specimens, but the live worms actually contract when disturbed into a shape approximating that of a peanut. They feed with the aid of ciliated tentacles. Since they spend most of their time burrowed in the sand, they "eat" as much sand as they do other matter. For the marine aquarium they make excellent scavengers, but you must be careful that they are not placed in with large fishes, for the fishes will quickly make a meal of them.

STARFISH

The symbol of the beach is undoubtedly the starfish, a dread to mussel and clam fishermen. This peculiar animal is built with the destruction of shellfish in mind. It uses its powerful suction arms to wrap about the shell of a clam. The starfish opens up the shell enough to send its stomach *inside* the clam's shell. After some hours, while digestion of the clam takes place outside the body of the starfish, the starfish releases its hold, pulls in its stomach and looks for another victim.

Starfish have wonderful powers of recovery. The legend that if you cut a starfish into several parts, it will reproduce itself in each part, is true!

Not all starfishes have the usual five arms. Some have four and some have six. Even those starfish that normally have five may be



1. Tide pool



2. Blenny



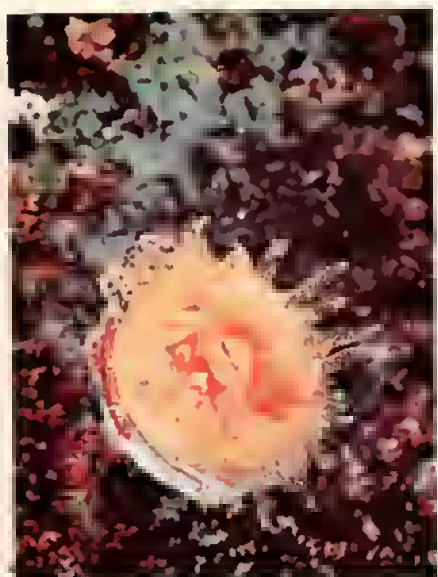
3. Peanut worms



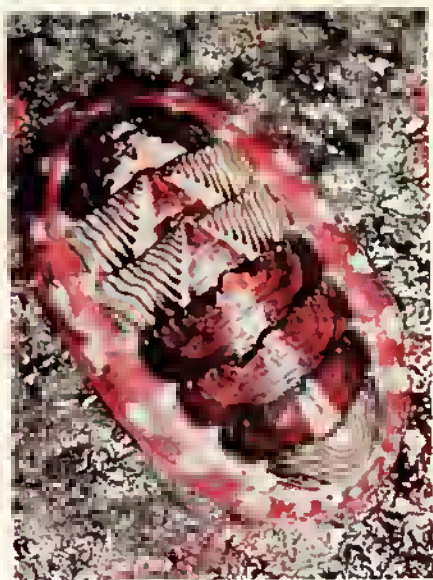
4. Sea Bat starfish



5. Periwinkles.



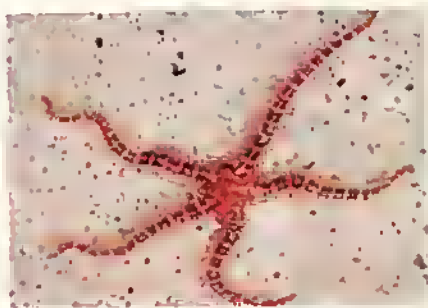
1. Coral polyp



2. Chiton



3. Shore crab



4. Brittle star



5. Chitons (curled for protection)



6. Chitons grazing.



This photo shows only one species of starfish, with from four to seven arms. N.Y.Z.S. Photo.



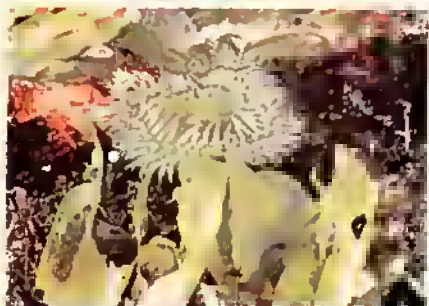
These are some of the things you might find on a beach. The upper two invertebrates are Sea Urchins (the one on the left is olive, but with most of its spines worn off; the one on the right is a "sand dollar", sand-smoothed remains of a Sea Urchin). The lower four figures are starfish. N.Y.Z.S. Photo.



1. Feather worm



2. Prying loose an abalone



3. Sea anemone



4. Sculpin



5. A tide pool teeming with life.



1. Limpet



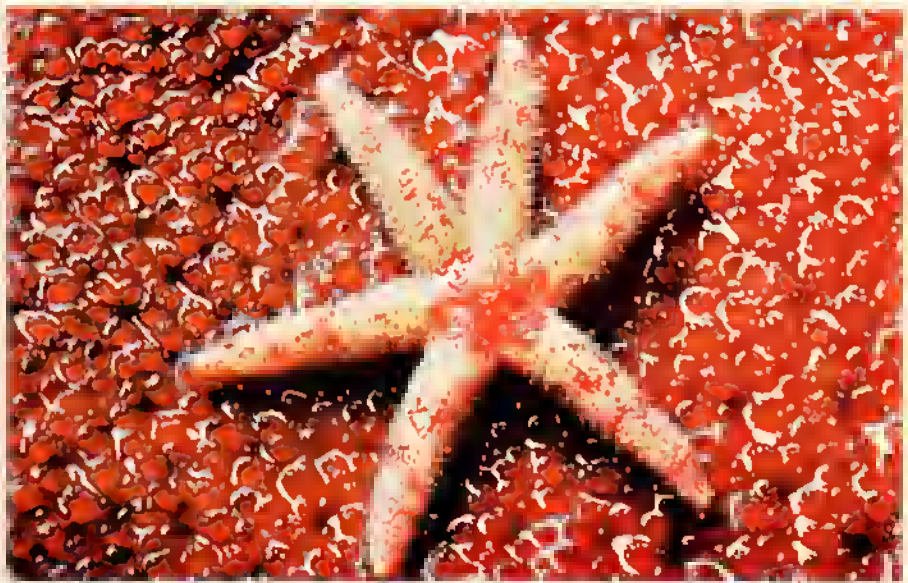
2. Sea Urchin



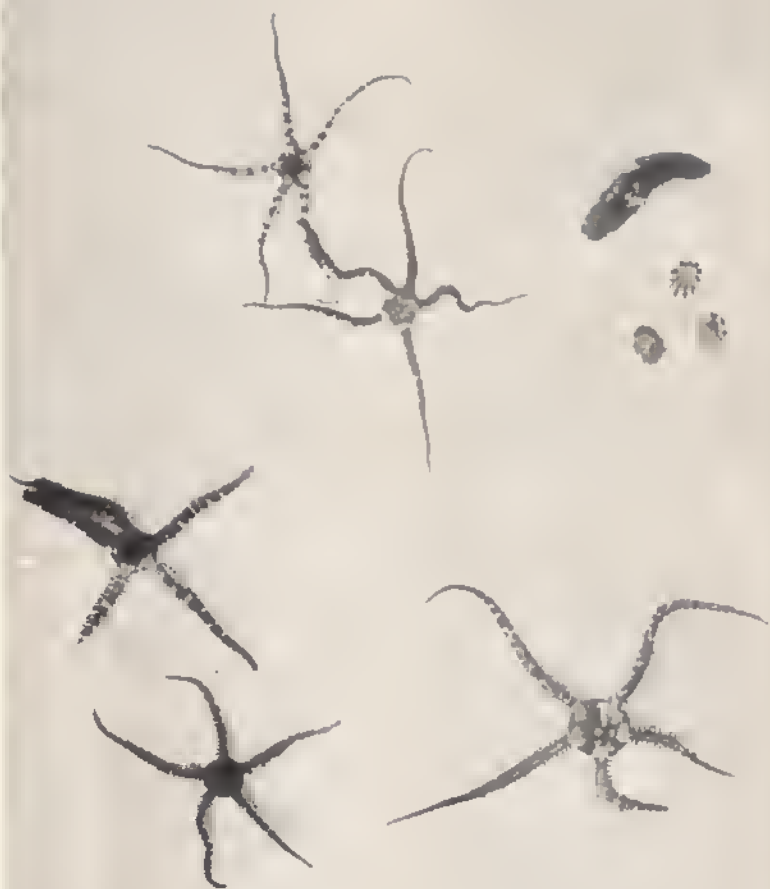
3. Whipping-top snails



4. Cancer crab



5. Six-armed starfish.



The broken-off arms of the brittle starfish are regenerated in remarkable fashion. It is interesting to observe the various ways in which the arms grow back., N.Y.Z.S. Photo.



Starfish feed mostly on clams and mussels, and are their worst enemy.
Photo by Gunter Senfft.

found at certain times to have anywhere from one to seven arms! What an amazing creature . . . and all this without a brain (for the starfish has no head . . . just arms and a mouth).

Brittle stars (*Ophiothrix spiculata*) too can regenerate their arms. They look like baby octopuses.

SEA URCHINS

Among the many interesting animals to be found in tropical tide pools, as well as along the beaches and shores of most tropical islands, is the Sea Urchin. The Purple Sea Urchin (*Strongylocentrotus purpuratus*) and the Red Sea Urchin (*S. franciscanus*) are found commonly along the Pacific coast. Various other Urchins are found all over the world. The Black Sea Urchins, found in the West Indies, have very long spines which are movable to some degree.

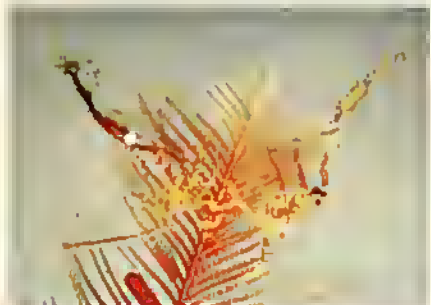
It is common practice for a Sea Urchin to turn its spines in the direction of the expected assault. Along with this equipment, the Sea



1. A crab smaller than a fingernail.



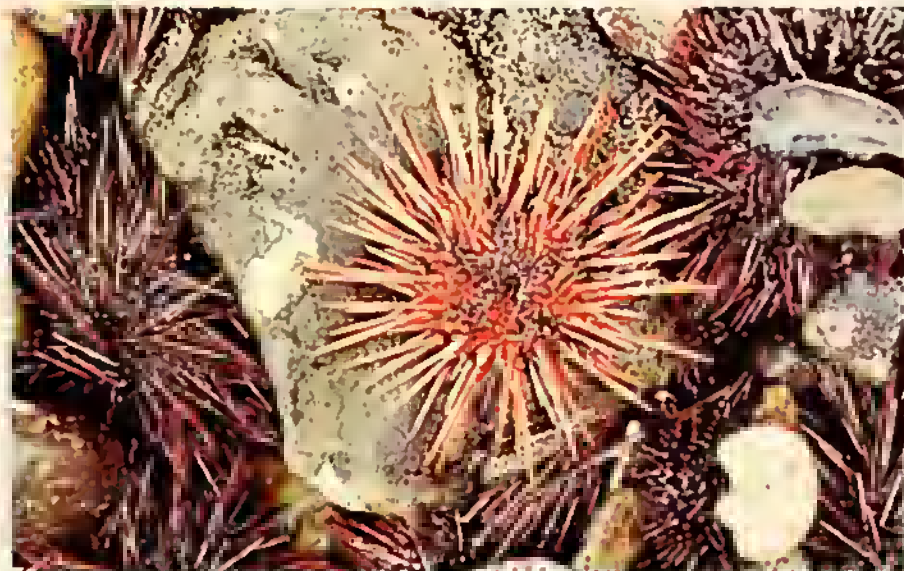
2. Parcelain crab.



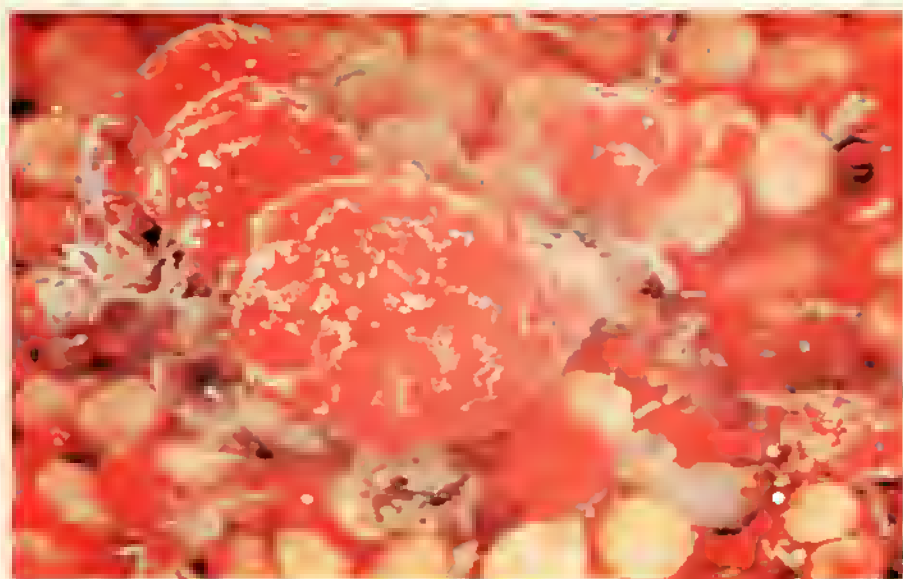
3. Caprella shrimp.



4. Mussels and gooseneck barnacles.



5. A colony of Sea Urchins, not a pleasant place to step.



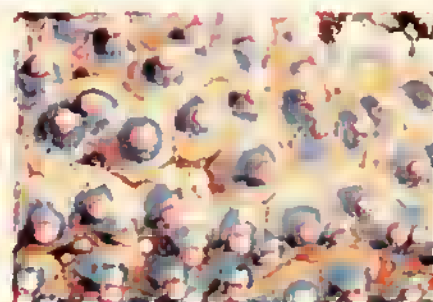
1. Sea squirt.



2 and 3. Sea slugs.



4. Starfish in motion.



5. Magnified section of a starfish's skin.



This tide pool is eight inches deep. It contains hundreds of tiny fishes, now hidden in coral crevices, plus some Sea Urchins.

Urchin is also provided with some fancy beak-like jaws (called *pedicellariae*). These jaws, which sometimes are in three parts, serve many purposes. Mainly they are used for crushing small animals that might try to attach themselves to the slow-moving Sea Urchin. They also may have poison glands for stunning larger animals so they can hold them better while they eat them. The Urchin's jaws, being very mobile, may also grasp food and pass it along to the mouth.

Sea urchin eggs are used all over the world as human food . . . but every biology student will, at one time or another, study embryonic development, and when he does, he will undoubtedly learn the various phases of growth by observing the development of the Sea Urchin egg.

CHITONS (SEA CRADLES)

In the mollusk groups, closely related to the common clams and oysters, we find a very interesting marine animal known as the

chiton or sea cradle. The chiton is a sluggish, slow-moving creature that creeps about on a large foot, much like a snail. Across its upper surface are eight calcium-like plates, that articulate and overlap, forming a perfect protective shell when needed. The normal appearance of the chiton, uncurled, looks like the lower part of a lobster, but when it curls up it has a completely different appearance, like a cradle, from which its nickname was derived.

The habits of the chiton are nocturnal; during the day it remains quietly attached to rocks. Its rasping "tongues" work miracles in cleansing rocks of algae growths. The chiton is considered as valuable to a marine aquarium as fresh-water snails are to a fresh-water aquarium.

PERIWINKLES AND OTHER SNAILS

Periwinkles are another member of the mollusk group. These attractive little snails are suitable only in a covered aquarium because they climb. In nature they are found mainly on high rocks overlooking the water. They protect themselves from dehydration by spinning a mucus-like film about themselves. This film also acts as a holdfast mechanism so they are not swept away by birds, waves, winds, etc. An interesting tale is told of a periwinkle (*Littorina planaxis*, the species illustrated), which was eaten by a sea anemone. After spending 24 hours in the digestive cavity of the sea anemone, the periwinkle "walked away" uninjured!

Other snail shells are often to be found when collecting tide pool life. What seems to be an empty shell may be the home of a hermit crab out looking for food. The crab moves from one shell to another, depending on its rate of growth.

Many of the "top shell" snails (they get their names from the fact that their conical shells resemble a spinning top) house hermit crabs, as we have illustrated.

Snails eat by means of a rasping device which acts like a file. As they rasp off a small piece of food, they pull it into their digestive system and eat it. (Fresh-water snails have a similar trait and they are responsible for many of the holes which appear in some of our lovely fresh-water plants.)

Reproduction in snails is well known to scientists. Most snails lay their eggs inside protective capsules or in jelly-like masses. Others, like the top shell snail, merely release their eggs freely into the water



A sponge crab, with sponges attached. Photo by Robert P. L. Straughan.

Scallops, molluscs which can move rapidly through the water. Photo by Dr. Herbert R. Axelrod.





Alegonium palmatum, the sea hand or leather coral. Photo by Holzhammer.

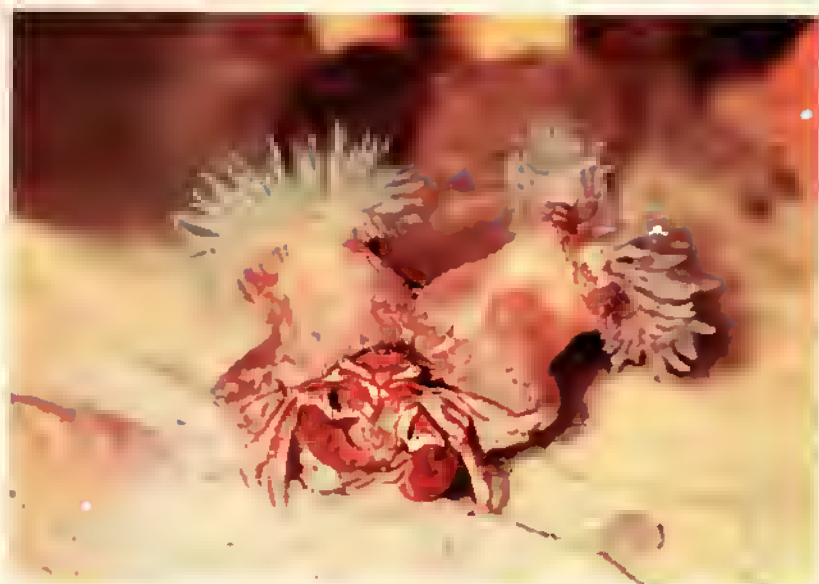
The mat coral, **Cladocera caespitosa**. Photo by Holzhammer.





Stenopus hispidus, the banded coral shrimp.

where they may or may not be fertilized by the sperm which was similarly released. The young are free swimming for a short time (as are most of the larval forms of shell fish in order to insure a fairly wide dispersion of the particular species).



Eupargus bernardus, carrying a pair of anemones on its back.

A banded coral shrimp resting on a piece of pipe-organ coral. Photo by Robert P. L. Straughan.



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